Roanoke River

National Wildlife Refuge

Annual Narrative

Windsor, North Carolina
Calendar Year 2010

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Feedback

FORWARD

The Roanoke River National Wildlife Refuge (Refuge) staff along with numerous other stakeholders came to settlement in the cooperative FERC relicensing with Dominion Generation (DG) after ten years of meetings. DG was issued a new license on March 31, 2004. The license was amended in March 2005 to replace articles requiring DG to cooperate with the various agencies that make up the Cooperative Management Team (CMT) and conduct studies and monitor the impacts of the managed flows on resources downstream of the dam. The CMT was made up of representatives from North Carolina Wildlife Resources Commission, the North Carolina Department of Environment and Natural Resources, the U.S. Fish and Wildlife Service (FWS), the National Marine Fisheries Service, and the Regional Partnership of Local Governments in an ex-officio capacity. The staff's input has been through participation in the Fisheries and Terrestrial Committees.

River flow would determine, to a very large degree, the success of the FWS's potential refuge habitat management strategies. The Refuge staff has always, since early in the relicensing process in 1994, recognized that DG (formerly North Carolina Power) was a lesser player in river flow management decisions. The belief was, and continues to be, that the United States Army Corps of Engineers (USACOE) was the major player through flood control operations. However, when one considers the extent that the USACOE is also involved in hydro-power production, it gives one cause-to-pause regarding the driving force behind the USACOE's flood waters release policies. For instance, when winter flood releases are such that prolonged, moderate flows cause water to remain on the floodplain far into the growing season of spring, one could question the objective. Is it flood control or hydro-power production to fulfill contracts with Southeastern Power Administration? If releases are to prevent flood damage, why are they such that the resources in the lower ecosystem, including the Refuge, are damaged? If the USACOE Project, Kerr Dam, was built for flood control or to prevent flood damage, why not maintain 35,000 cfs releases in a manner that will disperse flood flows downstream during the dormant season as quickly as possible, mimicking more natural conditions? The 35,000 cfs flows flood the Refuge 14-16" deeper than 20,000 cfs flows, but the latter prolongs, sometimes by several weeks, flood releases. A lot of interested citizens on the floodplain below the project continue to ask questions. The fact that a lot of people, including Refuge staff, are asking questions is the reason Congress funded the current USACOE's Section 216 Study. The Section 216 study, designed to allow the USACOE to review their flood control operations and releases at their John H. Kerr flood control project, got underway in 2005.

Refuge staff continue to participate in various task group meetings ranging from downstream ecosystem, water quality, and recreation, to channel morphology. It is in these task groups that issues are being discussed and studies are designed to address them.

INTRODUCTION

The Roanoke River National Wildlife Refuge (Refuge) was established 10 August 1989, to protect and enhance wooded wetlands consisting of bottomland hardwoods and swamps with high waterfowl value along the Roanoke River (River). The Refuge acquisition boundary involves wetlands in a 130-mile section of the River from the fall line in Weldon downstream to the Albemarle Sound near Plymouth, North Carolina. This area of floodplain encompasses approximately 150,000 acres (235 square miles) of which 33,000 acres are in the Refuge acquisition boundary. Current Refuge acreage totals 20,978. North Carolina Wildlife Resources Commission (NCWRC) acquisition totals approximately 26,000 acres. Both agencies' lands are managed as a joint venture, between the U.S. Fish and Wildlife Service and NCWRC, with the exception of a 45-acre fee title easement in Nash County. The Refuge headquarters office is located in the Town of Windsor in Bertie County, North Carolina.

The portion of the Refuge along the River includes part of an extensive wetland ecosystem that contains excellent examples of a number of southeastern plant communities. These are grouped into three natural community types: levee forest, cypress-gum swamp, and bottomland hardwoods. The 45-acre Nash County satellite includes a beaver impounded stream with button bush cover. The 129-acre Sampson County satellite consists of pocosin wetlands.

The River floodplain is relatively narrow from Weldon to Scotland Neck, at times only a mile in width, with natural levees and ridges alternating with sloughs and backswamps in rapid succession. Current Refuge acreage does not include lands in this upper River reach. In the middle section of the lower River, the floodplain becomes flatter and broader, commonly reaching a width of two to three miles, with cypress-gum backswamps increasing in size. The continued presence of levees and ridges make this stretch of floodplain the most diverse and, potentially, the most productive. There are 15,000 acres of Refuge lands in this lower-middle River reach. Below Jamesville the River is essentially at sea level and broad expanses of cypress-gum swamp, as much as five miles across, predominate. In addition to the major vegetation communities described above, occasional oxbow lakes, beaver ponds, and blackwater streams are located throughout and add to the rich mosaic of habitat types in the River's floodplain. Together, these habitats support a rich array of diverse and abundant fish and wildlife species. A total of 6,000 acres in this River reach are designated Refuge lands.

The River floodplain includes some of the more valuable wetlands for fish and wildlife. Fourteen species of waterfowl regularly utilize the floodplain's wetlands. Wood ducks, mallards and wigeon are the most abundant. Other frequently observed species are black duck, pintail, gadwall, green-winged teal, blue-winged teal, ring-necked duck, hooded merganser, shoveler, bufflehead, Canada goose, and tundra swan.

At least 214 species of birds, including 88 breeding resident and migratory species, utilize the River's floodplain. The area supports the highest density of nesting birds, especially songbirds, anywhere in North Carolina. The project area has several rookeries

that contain great blue herons, snowy and great egrets, anhingas, and yellow-crowned night herons.

The River, its tributaries and associated floodplain wetlands, provide critical habitat for a diversity of fish species, including anadromous fish. Anadromous fish utilizing the system are striped bass, blueback herring, alewife, hickory shad, and American shad. The status of the endangered shortnose sturgeon is unknown.

The River's floodplain also has a high density of white-tailed deer. A remnant population of black bear exists along the lower River. Gray squirrels and marsh rabbits are abundant. Resident furbearers include raccoon, mink, muskrat, otter, fox, bobcat, beaver, and opossum.

The River's bottomland hardwood habitat supports one of the largest natural wild turkey populations in North Carolina. The prime bottomland hardwood trees on the ancient river ridges and terraces provide excellent food and cover for feeding and nesting turkeys. Limited woodcock also occur along the River. Bobwhite quail occurred in some of the bottomland hardwood habitats in the early 90's, but have not been heard since approximately 1995.

Historical economical uses have been commercial fishing and logging. Logging operations were aimed primarily toward harvesting cypress and green ash. Some cypress-tupelo swamps have been changed to mainly tupelo with a few scattered cypress. Some areas have only small quantities of the ash component. Recreational uses are primarily hunting and fishing.

The Refuge also administers 66 conservation easements consisting of approximately 116 sub-tracts, totaling 2,871 acres. These easements are located in 19 counties, some as far away as 200 miles from Refuge headquarters. The easement and private lands programs were elevated in 1996 with the addition of one staff position, a Private Lands Biologist. When the Private Lands Biologist transferred in 2001, the position was moved to the U.S. Fish and Wildlife Service Wildlife Habitat Management Office, Manteo, NC; however, the easements remained the responsibility of the Refuge. These parcels are generating ever-increasing demands. Shortfalls in staffing have placed the easements as a low priority.

Farm Service Agency (old FmHA) lands inventory also generated two fee title tracts totaling 174 acres; 45 acres in Nash County and 129 acres in Sampson County. There has been minimal management of these satellite areas. These small satellites, 100-200 miles from the Refuge headquarters, create many unique problems.

HIGHLIGHTS

- Four low water crossings were constructed on Town Swamp Tract
- Corrections to the engineering flaws on Plugs # 1 and 2 were completed this past summer.
- WB Richter continued to work with TNC, USACOE, DG, and NC and VA State officials regarding flow issues on the Roanoke River.
- BT Railey became a member of the Gulf Oil Spill Team when she responded to requests to participate in Beach Bird Surveys in Apalachicola, FL. This Oil Spill, a result of a fire and explosion on Oil Company BP's Deepwater Horizon Gulf Oil Rig, created an enormous environmental impact that will be felt for years to come.
- Thanks to the successful efforts of BT Railey the Refuge received $3,975 in funding from the Youth in Natural Resources Initiative. This funding allowed the Refuge to revitalize our dormant intern program and hire intern Matt Leeb for the summer. Matt worked on various projects throughout the Refuge under the guidance of WB Richter, BT Railey, and EEO Wilkins.
- BT Railey began work on a Herpotofaunal Inventory Protocol in anticipation of future studies.

CLIMATOLOGICAL REVIEW - 2010

Temperatures (in Fahrenheit)
Average high: 71.21
Average low: 50.01
Highest recorded: 101.70 (July)
Lowest recorded: 15.3 (February)

Precipitation (in inches)
Total for the year: 43.26 30 yr average: 47.20

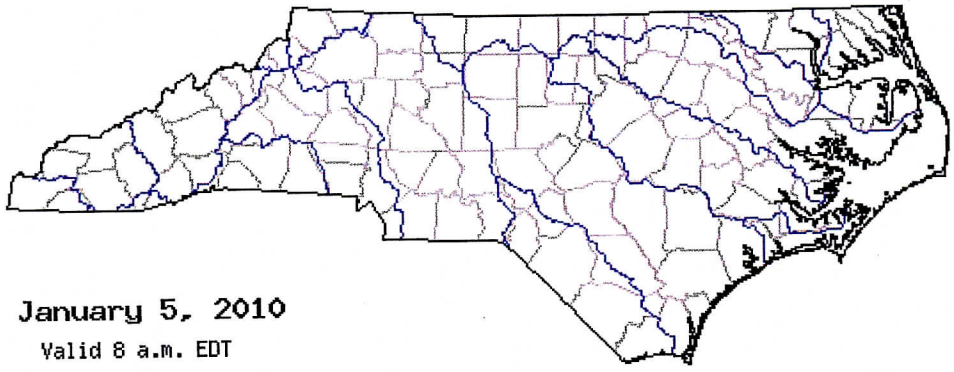
Data was recorded at the Peanut Belt Research Station in Lewiston, NC, which is approximately 20 miles from Refuge headquarters, and obtained from the State Climate Office of North Carolina. All data (100%) was available for 2010.

Snow observations for the month of December were not available from Lewiston, snow event records are from http://www.erh.noaa.gov/rah/events. Records show 3 snow events for the year; a trace amount on December 04-05, 1" on December 16, and 10" on December 25 - 26. Once again temperatures varied considerably with a low of 15.3 degrees on February 1st, followed by a high of 50.4 degrees days later. Temperatures in January were similar to last year, averaging a maximum of 47 degrees, with one day in the low 70's. January averaged the coldest maximum temperatures (27 degrees), but temps did reach 71.9 degrees on the 17th. Spring began in March with high temperatures hovering in the 60's and a high of 77.3 on March 20th. The middle of summer had the highest temperature this year, reaching 101.7 on July 7th. September again had the lowest with 52.7 on the 11th.

Drought conditions in North Carolina continue to vary throughout the year. 2010 began with all counties under normal conditions and remained that way through most of April. Beginning in the later part of April, counties in the middle of the State began experiencing abnormally dry conditions. By the beginning of May all of North Carolina's eastern counties were considered abnormally dry. Considerable rainfall over the latter part of May eased conditions back to nearly normal levels. By the middle of July all counties in the middle part of the State, east to west, were again abnormally dry and a few counties in the upper northern part of the state were considered to be under moderate drought conditions. August was all over the place with some counties being under normal conditions with others considered to be in severe drought. September's large rainfall (15.35 inches) helped the eastern counties where conditions improved to normal levels and remained so until near the end of November when we were once again considered abnormally dry. The Refuge ended the year under abnormally dry conditions and some middle southern counties were considered to be under extreme drought. Precipitation averages ranged from a low of .57 inches rainfall in November to a high of 15.35 inches in September, with 5.93inches occurring on the September 29th.

Month	Precipitation
January	2.99
February	3.03
March	4.80
April	.84
May	4.82
June	2.26
July	1.25
August	3.78
September	15.00
October	1.19
November	.57
December	.08
Total	**43.26**

US Drought Monitor of NORTH CAROLINA



January 5, 2010

Valid 8 a.m. EDT

Drought Classifications

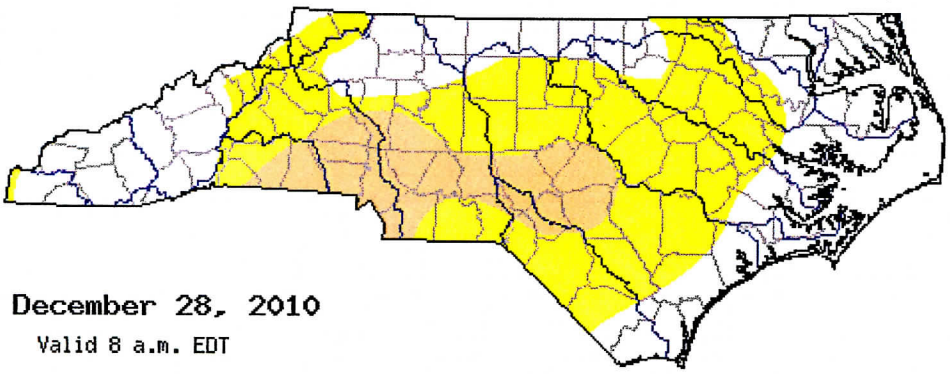
- D0 - Abnormally Dry
- D1 - Moderate Drought
- D2 - Severe Drought
- D3 - Extreme Drought
- D4 - Exceptional Drought

County Boundaries Major River Basins (View Map)

A = Agricultural (crops, pastures, grasslands)

H = Hydrological (water)

The U.S. Drought Monitor focuses on broad scale conditions. Information provided for North Carolina is relative to the information provided from all other states and the North Carolina Drought Management Advisory Council. Local conditions may vary.



December 28, 2010
Valid 8 a.m. EDT

US Drought Monitor of
NORTH CAROLINA

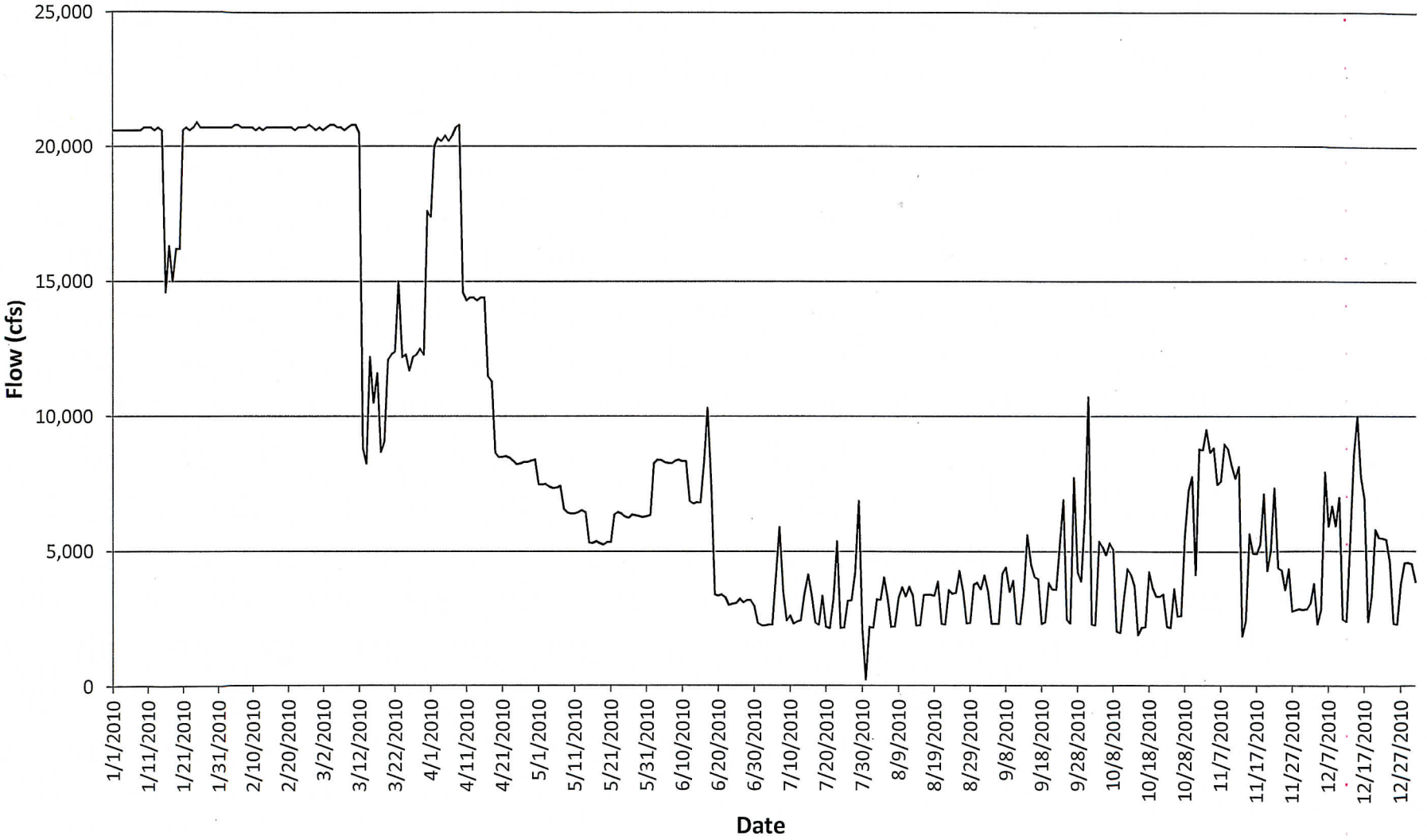
Drought Classifications
- D0 - Abnormally Dry
- D1 - Moderate Drought
- D2 - Severe Drought
- D3 - Extreme Drought
- D4 - Exceptional Drought

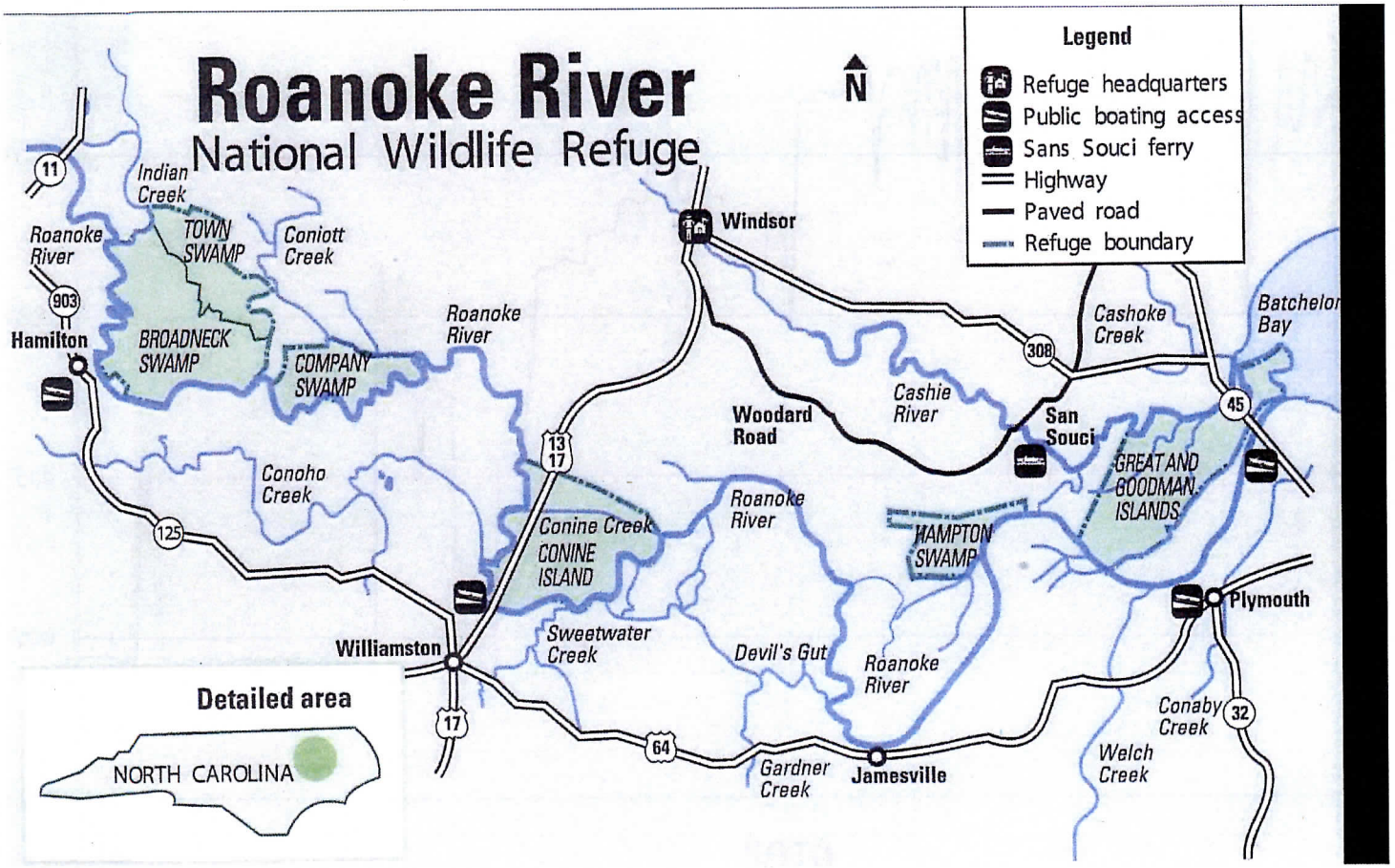
County Boundaries Major River Basins (View Map)

The U.S. Drought Monitor focuses on broad scale conditions. Information provided for North Carolina is relative to the information provided from all other states and the North Carolina Drought Management Advisory Council. Local conditions may vary.

The images above were copied from the archives at http://www.ncdrought.org/archive/index.php.

Discharge from Roanoke Rapids, NC
2010




Roanoke River
National Wildlife Refuge
N
Legend
Refuge headquarters
Public boating access
Sans Souci ferry
Highway
Paved road
Refuge boundary
Windsor
Hamilton
Williamston
Plymouth
Jamesville
Woodard Road
San Souci
Indian Creek
TOWN SWAMP
Coniott Creek
Roanoke River
BROADNECK SWAMP
COMPANY SWAMP
Conoho Creek
Conine Creek
CONINE ISLAND
Sweetwater Creek
Devil's Gut
Gardner Creek
Cashie River
Cashoke Creek
Batchelor Bay
GREAT AND GOODMAN ISLANDS
HAMPTON SWAMP
Welch Creek
Conaby Creek
11
903
125
13
17
64
308
45
32
Detailed area
NORTH CAROLINA

1

Monitoring and Studies

1a. Surveys and Censuses

Notable wildlife occurrences at Roanoke River National Wildlife Refuge (Refuge) in 2010:

- A pair of bald eagles nested again this year on the Company Swamp tract.
- The large woody debris study is well underway; all tags have now been deployed.

Monitoring Wood Duck Productivity – An overall summary of productivity is outlined followed by a more detailed summary of box clusters below in Table 1. The overall productivity of wood duck boxes was similar to last year. A total of 524 eggs were produced in 50 boxes with 316 eggs hatched as compared to 582 eggs produced in 2009 in 32 boxes in which 292 hatched. In an effort to reduce the occurrence of prothonotary warblers building their nests in wood duck boxes, 12 nest structures were given to the Refuge by Dr. Eugene Hester. The structures consist of a Metamucil container with its top painted black and an entrance hole drilled in the front. Holes were drilled in the bottom for drainage and on the back to weave an anchor wire though. In 2009, WB Richter along with volunteer Jim Brown affixed all twelve structures on the back of the poles of those wood duck boxes that had repeat occurrences of warbler use over the years. None of the structures were used this year. Maybe we'll have better luck next year.

Eight boxes remain on the lower Roanoke River. The rest were previously taken down due to problems with dump nesting, corroding hardware, and predator guards. The eight boxes were checked in June and February (2010). Nesting attempts by wood ducks were made in all eight boxes. Dump nests (>20 eggs in a clutch) occurred in only one of the eight boxes this year. The total number of eggs laid was 127, including 83 (65%) hatched and 66 (52%) unhatched. The total number of eggs hatched this year compared to last year was similar, last year 61% of the eggs laid hatched.

Boxes located on Broad Creek (11 boxes) and Grennell Creek (8 boxes) were monitored and maintained. Of the 19 boxes, 13 (68%) had active wood duck nests with 96 (69%) of the 139 eggs hatched. This compares to last year in which 9 (47%) active wood duck boxes were observed with a total number of 134 eggs laid and 68 (51%) hatched. There was one box that contained a dump nests (>20 eggs) this year and prothonotary warblers or great crested flycatchers used five of the boxes.

Twelve boxes were checked on Welch Creek. A total of eight boxes were used by wood ducks this year; the same as last year. Boxes were checked in June and February (2011). Data collected indicates 115 eggs were laid with 71 (62%) hatching. Prothonotary warbler nests were found in three of the boxes.

The Eastmost River has nine boxes of which five were used by wood ducks compared to three last year. Of the five boxes used, 113 eggs were laid compared to last year when 63 eggs were laid. The success decreased to 51 (45%) hatched this year from last year's 39 (62%) success rate.

WB Richter and EEO Wilkins cleaned and checked the boxes in Rainbow slough February 2011. A total of 22 wood duck boxes can be found at this location. A total of 16 boxes were used by either wood ducks or hooded mergansers. Total number of eggs found were 100, of this 70 (70%) were hooded merganser eggs and only 30 (30%) were wood duck eggs. Of the hooded merganser eggs a total of 27 (38%) hatched and 15 (50%) of the wood duck eggs hatched. A prothonotary warbler nest was found in one, screech owl egg in another, and three boxes had both wood duck and hooded merganser eggs present.

Table 1: Wood duck box productivity data for 2010 on Refuge lands.

	Total Number of Boxes	Total # Boxes Used by Waterfowl	Total # Eggs	# WODU Hatched	# WODU Not Hatched) NH	# Dead Chicks	Hooded Merganser NH	Hooded Merganser Hatched	# Boxes with POWA Nests	Dump Nests
Rainbow	22	16	30	15	16	1	43	27	1	0
Lower River	8	8	127	83	66	6	0	0	2	1
Welch Cr.	12	8	115	71	41	3	0	0	3	1
Eastmost	9	5	113	51	69	6	0	0	1	3
Broad/Grennell Cr	19	13	139	96	31	2	0	0	5	1
TOTAL	**70**	**50**	**524**	**316**	**223**	**18**	**43**	**27**	**12**	**6**

Cerulean Warbler Survey – No survey was conducted this year due to lack of staff time and inadequate environmental conditions.

Roanoke River NWR Breeding Bird Point Count Surveys on Levee Habitats -
WB Richter conducted point counts on established transects (2 on Broadneck Swamp, 1 on Conine Island, and 1 on Company Swamp) each containing 10 points located 250 m apart. This was the sixth year point count data was collected in the hardwood plantations located on Refuge lands purchased in 2004. Green ash, sycamore, and sweet gum plantations made up the fifteen point count plots in the plantations. Within the next few years plans are to manipulate these plantations to promote more diverse hardwood stands. The point count data will serve as a baseline for comparison after stand manipulation is completed.

Each of the 55 points were visited at which time birds seen or heard within 25 m, 50 m, and over 50 m were recorded at 0-3 minutes, 4-5 minutes, and 6-10 minutes time intervals. The protocol used is based on the Hamel, et. al. "**A Land Manager's Guide to Point Counts of Birds in the Southeast**" and has been adopted with minimal modification by Regions 4 and 5. All points are located 50 m from the River and are in levee habitat. The objectives of this monitoring study are to 1) monitor, overtime, the effects of aseasonal flooding on bird populations; 2) document the density and diversity of birds on the River levees; 3) assist Refuge staff on determining habitat management objectives and priorities for the Refuge; and 4) use the standardized protocol to allow one to compare bird population trends on an ecosystem, regional, and national scale in similar habitat types. The goal is to have a total of 50 points in this one habitat type as recommended by WB Chuck Hunter, FWS Southeast Regional Office.

Table 2 summarizes the 2010 data as it compares to the point count data collected in past years. In reviewing this Table, some notable observations are:

- There was not one species that stood out as being significantly more abundant this year than in years past. However, the following species were notably less abundant this year: Eastern tufted titmouse, blue-gray gnat catcher and red-eyed vireo. There continues to be an evident downward trend in the number of prothonotary warblers on the levee plots with numbers remaining relatively stable on the plantation plots.
- Listed in order of abundance, the five most abundant bird species counted on levee sites in 2010 were: Carolina wren, American redstart, Acadian flycatcher, red-eyed vireo and white-eyed vireo. This compares with last year's abundance of Carolina wren, American redstart, blue-gray gnatcatcher, Acadian flycatcher, and red-eyed vireo. The average number from previous years (1999-2009) indicates that the five most abundant species were: American redstart, Carolina wren, red-eyed vireo, blue-gray gnatcatcher, prothonotary warbler.
- On levee sites, the most widespread species (species with the highest number of occurrences) listed in order of highest to lowest occurrence were: Carolina wren, Acadian flycatcher with northern cardinal and white-eyed vireo tied for third, and American redstart and red-eyed vireo tied for fourth and the blue-gray gnatcatcher, eastern tufted titmouse and red-bellied woodpecker tied for fifth. As compared to occurrence of species tallied from 1999-2009 in which the most

widespread species was the red-eyed vireo, Carolina wren, Acadian flycatcher, northern cardinal, American redstart.

- On plantation sites, the most widespread species (species with highest number of occurrences) this year listed in order of highest to lowest occurrence were: Acadian flycatcher and American redstart tied for first, red-eyed vireo and Carolina wren tied for second, Carolina chickadee, common yellowthroat, northern cardinal and prothonotary warbler tied for third, American crow and white-eyed vireo tied for fourth and eastern tufted titmouse and summer tanager tied for fifth. As compared to occurrence of species tallied from previous years (2005-2009) in which the most widespread species was the Acadian flycatcher, American redstart, red-eyed vireo, Carolina wren and prothonotary warbler.
- Listed in order of abundance, the five most abundant bird species counted on plantation sites were: American redstart, Acadian flycatcher, red-eyed vireo, Carolina wren and Carolina chickadee. The average number from previous years (2005-2009) indicates that the five most abundant species were: American redstart, Acadian flycatcher, red-eyed vireo, Carolina wren and prothonotary warbler.
- The Cerulean warbler usually picked-up on the Company Swamp transect was not present for the second year in a row giving rise to the growing need to do a survey for this species on the lower River to determine the status of this species in this part of the Roanoke Basin.

Table 2: Comparative summary of levee and plantation point count data collected on Refuge lands in 2009 to levee point count data collected from1999-2010.

Species	# Occurrences Levee Sites 2010	Average # Occurrences**/yr. Levee Sites 1999-2009	# Individuals Levee Sites 2010	Average # Individuals/yr. Levee Sites 1999-2009	Occurrences** Hardwood Plantations 2010	Occurrences**/yr. Hardwood Plantations 2005-2009	# Individuals Hardwood Plantations 2010	# Individuals/yr. Hardwood Plantations 2005-2009
Acadian Flycatcher*	37	37.1	52	54.2	14	14.6	25	25.6
American Crow	18	15.9	26	22.9	7	6.4	10	9.0
American Goldfinch*	0	0.1	0	0.1	1	0.0	1	0.0
American Redstart*	33	36.5	74	74.0	14	12.8	34	36.0
Barred Owl	5	6.0	9	7.2	2	2.6	3	2.8
Blue Grosbeak*	0	0.3	0	0.3	1	0.4	2	0.4
Black-throated Blue Warbler*	0	0.9	0	1.0	0	0.0	0	0.0
Black poll warbler	0	0.7	0	0.8	0	0.0	0	0.0
Blue Jay	2	5.9	2	6.1	2	0.4	2	0.4
Blue gray Gnat Catcher	22	32.3	39	64.7	4	9.0	8	15.6
Brown-headed Cowbird	7	12.8	7	13.6	3	2.6	3	3.4
Canada Goose	0	2.1	0	5.0	1	1.0	2	2.4
Carolina Chickadee	25	23.2	44	44.0	8	6.4	15	10.0
Carolina Wren	39	38.0	75	71.9	13	12.2	20	19.0
Cerulean Warbler*	0	0.5	0	0.5	0	0.0	0	0.0
Chimney Swift*	5	4.8	8	7.0	2	2.2	3	4.2
Common Grackle	1	2.0	1	2.5	3	0.2	3	0.2
Common Yellowthroat	23	14.4	29	17.1	8	7.8	11	10.8
Downy Woodpecker	11	9.2	12	9.5	2	6.4	2	6.8
Eastern Tufted Titmouse	25	30.7	34	45.6	6	7.2	9	8.4
Eastern Wood-Pewee*	14	18.3	14	19.1	3	1.8	3	1.8
Fish Crow	1	2.5	1	2.7	0	0.8	0	0.8
Flicker Integrated	1	5.2	1	5.7	2	1.0	3	1.2

Gray Catbird	0	0.1		0	0.0		0	0.0	0	0.0
Great Blue Heron	3	1.4		3	1.6		0	0.0	0	0.0
Great Egret	1	0.9		1	0.8		0	0.0	0	0.0
Great Crested Flycatcher*	24	23.8		33	29.6		3	6.0	3	6.8
Hairy Woodpecker	2	4.1		4	4.6		3	2.0	3	3.2
Hooded Warbler*	10	11.2		10	13.2		4	3.0	5	3.0
Indigo Bunting*	15	10.8		19	11.9		2	4.8	2	5.2
Kentucky Warbler*	11	8.9		12	10.4		0	2.2	0	2.4
Louisiana Waterthrush*	0	0.3		0	0.3		0	0.0	0	0.0
Mourning Dove	7	7.6		8	7.9		2	2.4	3	2.8
Northern Cardinal	34	36.8		48	51.7		8	9.0	11	11.8
Northern Parula Warbler*	14	14.7		21	25.3		0	1.0	0	1.0
Orchard Oriole	1	0.4		1	0.4		0	0.0	0	0.0
Ovenbird*	8	3.6		9	4.1		4	4.2	8	6.4
Pileated Woodpecker	12	14.0		12	15.5		3	1.2	4	1.2
Prothonotary Warbler*	22	33.4		25	59.4		8	11.0	10	15.0
Red-bellied Woodpecker	25	29.2		37	38.6		3	2.4	4	2.4
Red-eyed Vireo*	33	38.8		51	71.4		13	12.4	23	20.6
Red-shouldered Hawk	6	3.1		6	3.5		0	1.6	0	1.6
Rufous-throated Hummingbird*	1	1.3		1	1.4		0	0.2	0	0.2
Rufous-sided Towhee	0	0.0		0	0.0		0	2.0	0	2.2
Scarlet Tanager*	3	4.0		3	4.3		1	0.8	1	1.0
Summer Tanager	16	17.7		17	19.3		6	4.8	7	5.0
Swainson's Warbler*	5	7.7		6	9.3		1	0.8	1	0.8
Turkey Vulture	0	0.7		0	0.7		0	0.0	0	0.0
White-breasted Nuthatch	11	12.1		15	15.4		2	1.4	3	1.8
White-eyed Vireo	34	30.2		49	37.6		7	5.6	12	6.8
Wild Turkey	2	1.2		2	1.3		1	0.0	1	0.0
Wood Thrush	17	17.7		20	21.7		1	3.2	1	4.2

Yellow-billed Cuckoo*	11	10.9	11	12.9	5	4.4	8	5.2
Yellow-throated Vireo*	5	6.0	5	6.1	2	1.0	3	1.2
Yellow-throated Warbler	0	0.3	0	0.3	0	0.0	0	0.0
White-throated Sparrow	0	0.1	0	0.1	0	0.0	0	0.0
Yellow-breasted Chat*	0	0.4	0	0.4	0	1.0	0	1.0
Field Sparrow	0	0.0	0	0.0	0	0.2		0.2
Prairie Warbler*	0	0	0	0	0	0.2		0.2
Total	40	43.6	857	958.0	15	15.0	272	272.4

Roanoke River NWR Permanent Forest Plots - In 2005 WB Richter collected data on five 40 m X 200 m forest health plots located on the Company Swamp, Conine Island, and Broadneck Tracts of the Refuge. The plots are located in the part of the floodplain that is inundated when discharges from the dam at Roanoke Rapids are a continuous 18,500 cfs or greater for more than five days. It is at this discharge that prolonged flooding during the growing season (commonly mid- to late-spring) occurs and is believed to adversely affect the health of the forests being flooded. There are two types of information being collected from these plots; 1) Monitoring the health of the already established trees, and 2) Monitoring the regeneration and survivorship of tree seedlings. The goal of this study is to monitor the dynamics of the bottomland hardwood forest communities at elevations inundated at flows of 18,500 cfs and document any changes. The objectives of the study, overtime, are to: 1) monitor changes in forest structure horizontally and vertically; 2) monitor the effects of managed flows on forest productivity; i.e., species diversity and tree growth; and 3) monitor survivorship of woody seedlings and saplings over a minimum of five years. In order to connect any of the changes observed over the year to managed flows, reference plots in another similar river system with a run-of-river flow regime must be established. Finding a reference plot nearby has proven to be difficult due to differences in scale of the Roanoke River compared to other river systems. The Roanoke River is much larger and has a floodplain that is more intact than other nearby rivers. Instead of locating another watershed, a more appropriate reference may be comparing the seedling survivorship data observed over different hydrological gradients along the Roanoke River floodplain with that found in the Dominion Generation hardwood regeneration study.

The protocol used to establish these plots and collect data follows closely with that discussed in a paper published in Castanea 63(3): 262-274; by R. K. Peet, T. R. Wentworth, and P. S. White and is titled "**A flexible, multipurpose method for recording vegetation composition and structure.**" In order to track the health of the mature trees each tree was given an individual number and data on overall tree health, height, and diameter was collected when the plots were first established in 2000 and 2001. In 2004 and 2005, a special effort was made to collect data on the large trees from each plot in order to assess the damage the prolonged flood event of 2003 had on the trees. The results of this effort were described in the 2006 Annual Narrative. Another attempt will be made to collect similar data in 2011. Data on tree health will be compared with previously collected data to look at overall changes in vegetation within and between plots and extrapolated to the surrounding bottomland forest community, where appropriate. Nested within each large 40 m x 200 m plot are twenty 1 m x 1 m seedling plots making a total of 100 on the floodplain. The seedling plots were established to monitor survivorship and productivity of different tree species. Data on ground cover, canopy cover, and presence of other species is recorded for each plot. This was the eleventh year data on all seedling plots (5 x 20 = 100 seedling plots) was collected.

Roanoke River NWR Reptile and Amphibian Survey - A total of 51 plots were established in 2005 with each plot consisting one 2' x 4' sheet of tin, one 2' x 4' sheet of plywood, and one 1½" pvc pipe. By 2007, the number of plots had been dropped to 49. Plots are concentrated on the Town Swamp, Broadneck, Rainbow, Company Swamp, and Conine Island tracts. The plots are located on various floodplain features including: levees - 20 plots; hummocks (high points, thought to be old dredge spoil piles, located on the levees) - 4 plots; high ridges - 8 plots; plantations (pine and hardwood) - 10 plots; and bottomland flats (Patuxent study plot on the Roanoke) - 7 plots. Of the 49 plots established, all 49 were checked in June 2010 by BT Railey, with logistical support from EEO Wilkins, Volunteer Farrar and Summer Intern Leeb. In October 2010, 14 plots were rechecked. BT Railey has written a draft protocol for this survey, and should complete it in 2011, with additional information on a Plantation Herpetofaunal Survey. This survey is to be implemented in early 2011, as the initial baseline data prior to potential active management of the plantations with the goal of creating more diverse wildlife habitat. Site locations of the 2005 study plots - now called the "Floodplain Features Herpetofaunal Study" - are currently being evaluated to determine if any plots should be abandoned or relocated. Data is summarized in Table 3.

Table 3: RRNWR Floodplain Features Herpetofaunal Study

		2005		2006	2007	2008	2009		2010	
SPECIES LATIN NAME	COMMON NAME	May	Oct	May-June	May-June	May-June	May-July	Oct-Nov	June	Oct
Hyla spp.	unknown tree frog				1					
Hyla cinerea	green tree frog	4	4	7	3	3	1	4	2	
Hyla squirella	squirrel tree frog			2	2		1	2	1	6
Hyla versicolor	gray tree frog	3	2	2	8	3	2	2	2	3
Scaphiopus holbrooki	spade foot toad			1						
Ambystoma opacum	marbled salamander	2			7	1		1	9	7
Plethodon spp.	slimy salamander			2	10	3	6	1		2
Plethodon glutinosus	slimy salamander	1								
Plethodon chlorybryonis	slimy salamander	3								
Eumeces inexpectatus	s.e. five-lined skink		1							
Notophthalmus viridescens	eastern newt								1	
Carphophis amoenus	worm snake	2		1		1	2			2
Thamnophis sirtalis	eastern garter snake								1	
# PLOTS SURVEYED (49 plots)		100%	27%	96%	100%	53%	59%	16%	100%	29%
# SPECIES OBSERVED		6	3	6	6	5	5	5	6	5

Askew Green Tree Reservoir Project – A map of the project area and summary of the results from the 2010 Emergent Vegetation Survey and Winter Waterfowl Survey is presented below (Figure 1). More detailed information can be found in the "Askew Tract – Water Management Project, 2010-2011 Report."

Askew Tract Emergent Vegetation Survey, September 2010

ASKEW TRACT EMERGENT VEGETATION SURVEY SPECIES LIST

Scientific Name	Common Name	Waterfowl Food Value*
Acer rubrum	red maple	Good (Wood Ducks)
Boehmeria cylindrica	false nettle	Not listed
Cyperus sp	*Cyperus*	Good
Echinochloa walteri	wild millet	Good
Hypericum virginicum	St. Johnswort	None
Leersia oryzoides	rice cutgrass	Good
Ludwigia sp	marsh seedbox	Fair
Murdannia keisak	marsh dewflower	Not Listed - A NON-NATIVE INVASIVE SPP.
Nyssa sp	tupelo	Not listed
Panicum dichotomiflorum	fall panicum	Good
Paspalum sp	*Paspalum*	Fair
Polygonum sp.	smartweed	Fair to Good
Saururus cernuus	lizard's tail	None
Taxodium distichum	bald cypress	Not listed

* Waterfowl Food Values taken from "Moist-Soil Management Guidelines for the USFWS Southeast Region, Appendix 1. A Waterfowl Food Value Guide for Common Moist-Soil Plants in the Southeast"

Vegetation surveys of emergent plants were conducted in one of the relatively open areas of Askew NW. They showed an overall low percent cover (15%) for those species known as the best waterfowl food value. From greatest to least cover, they included: *Leersia, Polygonum, Cyperus, Acer, Echinochloa*, and *Panicum*. The largest emergent plant cover (66%) was an invasive exotic, *Murdannia keisak*, with unknown value as a waterfowl food plant.

Askew Tract Winter Waterfowl Surveys, October 2010 – March 2011

Waterfowl surveys were conducted on a weekly to biweekly basis. They show significant use of the Askew tract by wood ducks year round; several other species of waterfowl used the habitat during winter months and migration periods, with the highest numbers (after wood duck) made up of Canada goose, mallard, ring-necked duck, and hooded merganser. Eleven species of waterfowl/waterbirds were documented in these surveys and included: American black duck, American green-winged teal, American wigeon, blue-winged teal, great blue heron, and great egret. Due to the inaccessible nature of the habitat, it is recognized that these surveys are not a total count of waterfowl; but do provide some record of the birds using the Refuge at this time of year.

Roanoke River NWR - Askew Green Tree Reservoir Project Area (Map from the WMP)

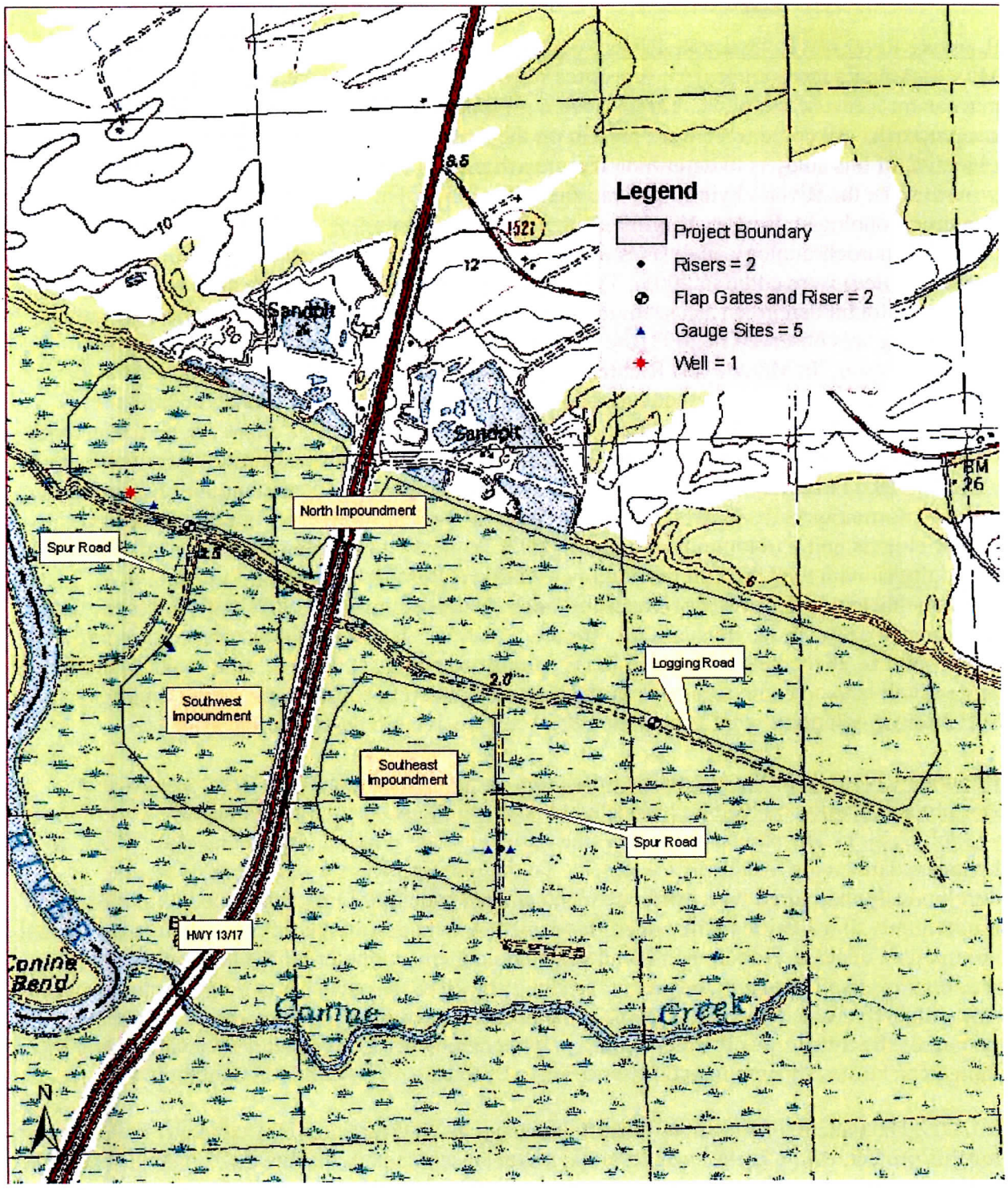


Fig. 1 2010 Emergent Vegetation Survey and Winter Waterfowl Survey

1b. Studies and Investigations

Roanoke River NWR "Roanoke River Tree Ring Analysis" (03-42630-01) - In 1999, as part of Ms. Hochman's research project, tree cores were extracted from large trees in or next to the permanent forest health plots. Target trees were green ash, American elm, laurel oak, and overcup oak. All cored trees were present on the floodplain before the dams were built. The objective of this study is to determine if a growth pattern exists that indicates reduced rates of growth since the River's hydrology was altered in 1953. Dr. Tom Yanosky, USGS, Dendrochronologist, Reston, Virginia, is the primary investigator. All cores have been measured and the dendrochronology analysis is underway. In addition 30 green ash (*Fraxinus pennsylvanica*) were cored in 2005. The core samples from the green ash have been analyzed and it was found that green ash seem to go very well in flooded conditions. In fact the largest growth ring was observed in 2003, the year the trees were inundated throughout the entire growing season. In March, WB Richter traveled to Reston, VA to discuss the project with Dr. Yanosky. It was decided that oaks should also be looked at. WB Richter agreed to core 13 laurel oak (*Quercus laurifolia*) trees and send the cores up to Dr. Yanosky's lab for analysis. A preliminary analysis of the cores has been carried out. WB Richter is waiting for the final results. Since Dr. Yanosky is now retired from the USGS, a significant amount of time lapses before information is made available as Dr. Yanosky is dealing with several family issues. WB Richter is going to look into trying to get Dr. Yanosky to transfer the data to Dr. Tom Doyle an Ecologist with the USGS at the National Wetlands Research Center in Lafayette, LA. Update, due to a lack of responsiveness from Dr. Yanosky and the USGS staff, the cores were not transferred to Dr. Doyle's lab in Louisiana as hoped. It was hoped that the cores could at some point be adequately analyzed and this project can come to a close but it looks as though the project will have to come to a close without an adequate report summarizing the findings. WB Richter will place what information has been received in the office file system.

Roanoke River NWR "Investigating Influences on Swainson's Warbler Nest Survival in a Bottomland Hardwood System Subjected to Asynchronous, Aseasonal Flooding" (04-42360-01) - The objectives of this study are to collect productivity and habitat utilization behavior data on the Swainson's warbler. To do this, Swainson's warbler nests were continuously monitored with infrared video cameras and adult birds were fitted with radio transmitters. If a significant managed flood event occurs during the field season it is hoped that a comparison of flood years to non-flood years could be made to determine if the altered flow regime impacts the foraging behavior and productivity of the species. During the study, another study objective was developed to look at the occurrence of extra-pair paternity in the mating system of the Swainson's warbler. This is a phenomena being revealed with several different thought to be strictly monogamous passerines; the Swainson's warbler is thought to be one.

In 2005, Dr. Lancia, Professor of Wildlife Science, NCSU, recruited PhD student, Neil Chartier, for this project. Mr. Chartier was awarded a special scholarship that covers tuition and provides a stipend for living expenses throughout the year. Mr. Chartier came from Eastern Michigan University where he received his MS degree. WB Richter has agreed to be a technical advisor on Mr. Chartier's graduate committee. The Refuge provided a vehicle and two boats as needed. For a summary of the collaborators on this study and history of funding refer to the 2007 Annual Narrative.

Last year was the fourth and final field season of this study; a final report in dissertation form is due in 2011.

Roanoke River NWR "The Dynamics of Woody Debris on the Coastal Plain Reach of the Roanoke River, North Carolina, and its implications for Aquatic Resources" (07-42360-01) - The principle investigator for this study is Dr. Cliff Hupp, USGS, Reston, VA. The subject expert is Dr. Bertrand Moulin, who resides in France, and collaborators are WB Richter and Mr. Ed Schenk, USGS, Reston, VA. Dr. Moulin has studied the dynamics of large woody debris on coastal rivers in France and has agreed to bring his expertise on woody debris to the Roanoke River. The study will look at how different flow regimes (flood control or hydropower peaking) effect the movement and generation of large woody debris (LWD) in the coastal plain reach of the River. In 2006 WB Richter and Dr. Hupp submitted a Science Support Partnership funding proposal to compete for USGS funds. In 2007 the project was funded for four years receiving an average of $22,500 per year.

The objectives of the study include the determination of:

- The spatial distribution within the channel of forms and volumes of LWD accumulation.
- The characteristics of LWD in transit and its temporal and geographical origin.
- The residence time of LWD in the River.
- The main transport mechanisms of LWD; i.e., hydropower peaking and/or flood control operations or none of the above.
- The development of a LWD budget and the prediction of the future of LWD budgets based on various management scenarios through modelling.

The goal of this work is to better understand spatial and temporal dynamics of LWD in large coastal plain rivers, specifically the Roanoke River from downstream of the dams to the Albemarle Sound (137 miles) in northeastern North Carolina. The first step involved reviewing the video footage of woody debris obtained though the USACOE 216 study and determine the spatial distribution, volume, and forms of woody debris within the channel. With an idea of distribution and types of LWD, pieces will be tagged with tracking devices. Locations of the woody debris will be checked periodically and movement will be correlated to flow releases.

The second part of this project will be to develop a LWD budget for the aquatic ecosystem. Volumes of LWD that are already present and/or potential in the River will be quantified. This will be based on rates of bank erosion Hupp et. al. determined in the Schenk et. al. 2009 study described in previous Annual Narratives, and the volume of trees on the levee, the geomorphic feature most susceptible to erosion. Based on the information and the current hydrologic regime, a predictive model of LWD will be constructed. The model will estimate the production, storage, and sources of LWD in the River based on dam releases. It is anticipated that the results of the proposed study will have broad application throughout the Atlantic and Gulf Coastal Plain. The project is scheduled to be completed December 2011; contingent on flood events.

Progress made this year: All tags have been deployed and the investigators are now waiting for some high flows to move the wood around. Also, a manuscript was submitted to the *Journal of*

Earth Surface Processes and Landforms this past year. The submitted paper is entitled: Distribution and Characterization of in-channel large wood along the low-gradient Roanoke River, NC. The abstract to the manuscript follows:

A 177 river km geo-referenced aerial survey of in-channel large wood (LW) on the lower Roanoke River, NC was conducted to determine LW dynamics and distributions on an eastern USA low-gradient large river. Results indicated a system with approximately 75% of the LW available for transport either as detached individual LW or as LW in log jams. There were approximately 55 individual LW per river km and another 59 pieces in log jams per river km. Individual LW is a product of bank erosion (73% is produced through erosion) and is isolated on the mid- and upper-banks at low flow. This LW does not appear to be important for either aquatic habitat or as a human risk. Log jams rest near or at water level making them a factor in bank complexity in an otherwise homogenous fine-grained channel. A segmentation test was performed using LW frequency by river km to detect breaks in longitudinal distribution and to define homogeneous reaches of LW frequency. Homogeneous reaches were then analyzed to determine their relationship to bank height, channel width/depth, sinuosity, and gradient. Results show that log jams are a product of LW transport and occur more frequently in areas with high snag concentrations, low to intermediate bank heights, high sinuosity, high local LW recruitment rates, and narrow channel widths. The largest concentration of log jams (21.5 log jams/km) occurs in an actively eroding reach. Log jam concentrations downstream of this reach are lower due to a loss in river competency as the channel reaches sea level and the concurrent development of unvegetated mudflats separating the active channel from the floodplain forest. Substantial LW transport occurs on this low-gradient, dam regulated large river; this study, paired with future research on transport mechanisms should provide resource managers and policymakers with options to better manage aquatic habitat while mitigating possible negative impacts to human interests.

Some of the only results we have gotten to date at the Moratoc Park fixed reader: We had 7 tags pass the reader with the fastest passing through the range of the antennae's in a little less than 2 minutes and the longest taking 4 hours. The average was about 4 minutes. As you can see, all of the tags went by on the rising limb of floods. Hopefully we can catch some more with a winter flood or at the very least the spring fish passage flows.

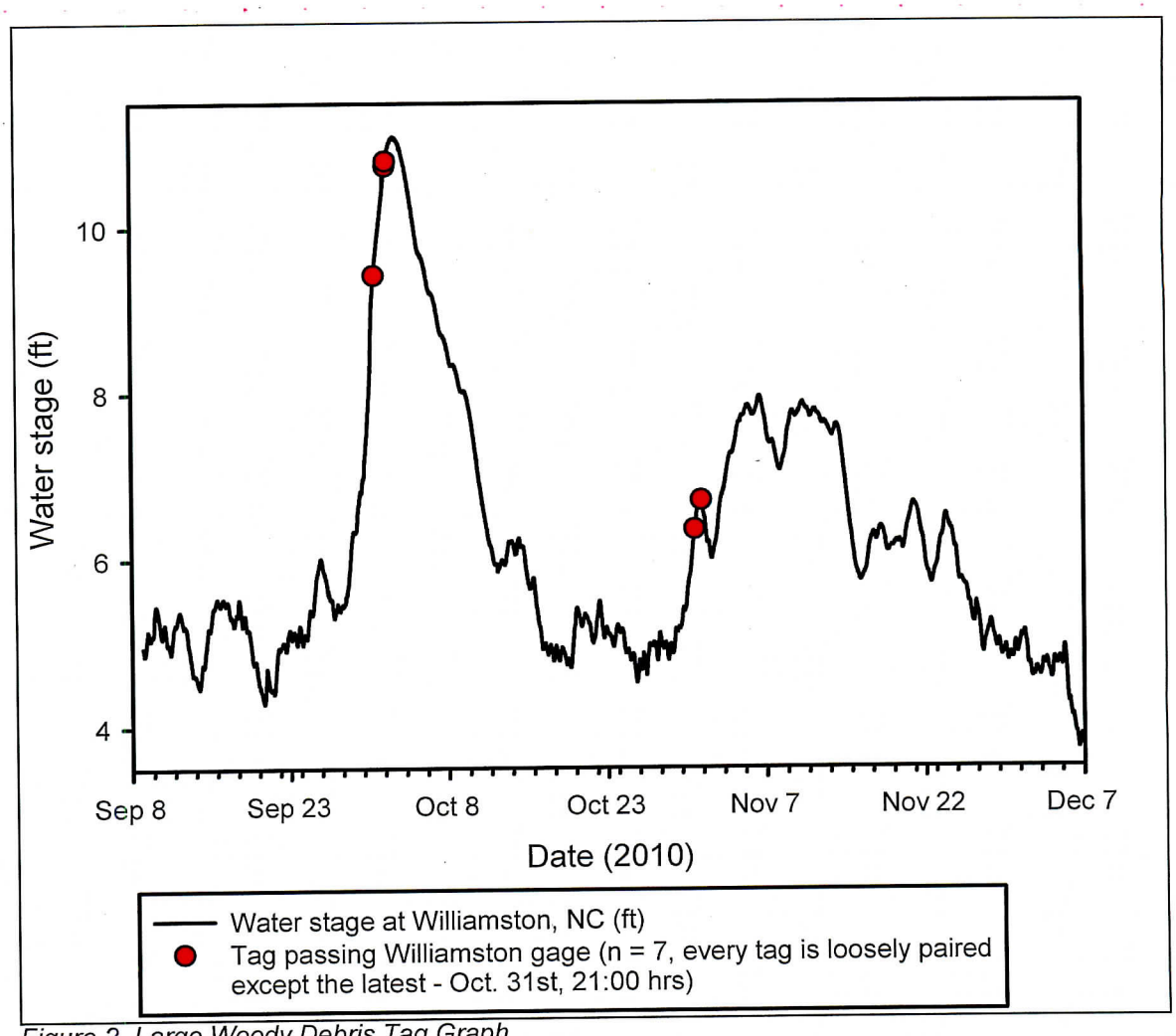


Figure 2. Large Woody Debris Tag Graph.
Ed Schenk. National Research Program, USGS, Reston, VA, phone: (703) 648-4746

Roanoke River NWR "The Effects of Artificial Canopy Gap Creation on the Growth and Development of Bald Cypress Advanced Regeneration on the Lower Roanoke River Floodplain, NE NC" (08-42360-01) – The overarching goal of this project is to determine the feasibility of restoring bald cypress back into canopy-level dominance in specific areas by significantly increasing available light to already established bald cypress saplings via the creation of artificial gaps in the canopy. Though some research has been conducted on the effects of increased light and decreased competition via thinning on residual adult bald cypress growth as well as the effects of varying light levels on young seedling growth, essentially no work has been done on the effects of increased light (release) on understory bald cypress saplings, especially when potentially stunted for long periods of time. These artificial canopy gaps would be created by killing overstory water tupelo trees (by girdling and herbicide injection) directly overtopping saplings within a local area. If the initial (first two growing seasons) growth response of bald cypress saplings is significantly positive, and continued yearly monitoring shows continued growth of at least a moderate pace, the herbicide treatment conducted on experimental

plots (and possibly other areas of the Broadneck tract) may be more widely applied throughout the Refuge where current bald cypress advanced regeneration exists.

A secondary project goal is a clearer understanding of the dates of past logging operations and a more thorough understanding of how past logging operations and continuous dam flow management regimes have affected the forest's development and individual tree growth.

This study primarily intends to examine the growth-response of bald cypress saplings to canopy gap creation. However, as mentioned above, there are several secondary avenues of research. All specific objectives of this study are listed below:

- To determine the rate of initial (first and second growing season) growth response of bald cypress advanced regeneration to significantly increased light conditions from artificial canopy gap creation. Growth and mortality response will be evaluated across sapling size and density gradients, as well as in reaction to initial overstory composition.
- To determine, using dendrochronological techniques, ages and past rates of growth of adult, overstory water tupelo in response to various environmental conditions and large scale alterations to local hydrologic regime (*i.e.*, dam building). If adequate hydrologic data is available, hydrologic conditions at the time of establishment for the present canopy trees will be evaluated.
- To determine, using dendrochronological techniques, ages and past rates of growth of adult, canopy bald cypress trees in an effort to determine an estimate of the general number and ages of cohorts on the floodplain and to similarly examine the species' response to local hydrologic regime (if adequate hydrologic data is available) and dam building.
- To monitor/examine current growth rates of bald cypress saplings in naturally existing gaps of various sizes.
- To utilize the above information in an effort to determine the feasibility of restoration of bald cypress into the forest canopy over significant acreage via release of existing advanced regeneration (of various sizes and densities) through artificial canopy gap creation.
- To utilize the above information in an effort to generally contribute to the overall knowledge concerning the effects of dam flow management on floodplain ecosystems.

METHODOLOGY

Basic Design – In order to clearly understand the effects of increased light on bald cypress sapling community growth and development, both treatment and control plots are necessary. These plots should capture the existing range of variation in terms of sapling size and density. A paired plot sampling design has been chosen, with each pair to contain a treatment plot in which all non-bald cypress woody vegetation will be girdled and injected with a herbicide and a control plot in which no treatment will be conducted. The herbicide *Habitat* has been chosen as it has proven effective for killing large water

tupelo trees in past studies. In order to create gaps in the canopy large enough to provide significantly increased light (full sunlight for many hours each day) and to prevent canopy re-closure, plots are to be 19 x 24 m in size. All non-bald cypress woody vegetation 1.37 m tall or larger rooted in treatment plots will be killed, as will all non-bald cypress woody vegetation outside the plots which shades any portion of the plots from direct overhead light. Initially, treatment and control plots will be generally paired based on relatively close location (i.e., similar hydrology – no plots further than 0.4 km apart, most 60 - 100 m apart) and similar bald cypress sapling density and size characteristics. Any individual treatment and control plots will be kept at least 40 m apart to avoid edge effects on the control plots from artificially created canopy gaps in treatment plots. Fourteen pairs of plots have now been established. Target tupelo trees were treated in November of 2008.

2

Habitat Restoration

2a. Wetland restoration: On-Refuge

In 2004, Refuge staff partnered with Ducks Unlimited (DU), TNC, and NCWRC in putting together a package of wetland restoration, enhancement, and acquisition projects throughout the Roanoke River Basin. The package totaling just under one million dollars was submitted to the North American Wetlands Conservation Council to compete for NAWCA funds. WB Richter proposed two projects for the Refuge. The first is geared towards enhancing approximately 500 acres of cypress/tupelo swamp habitat. The basal area of water tupelo will be reduced in areas where tupelo is the dominant species in an effort to open up the canopy. Target trees will be injected with the herbicide Habitat and left to die. The dead trees will provide nesting and foraging areas for cavity nesting birds and food for insectivores. By opening the canopy the expected outcomes of this project will be to increase the density of cypress in these stands and to increase emergent plant growth that will benefit wintering waterfowl when these areas flood. The Refuge received $50,000 for the tupelo injection portion of the project. WB Richter is working with Dr. William Conner, Clemson University, SC, to carry out the project. Dr. Conner has recruited a Master's student, William deGravelles, to work on this project. The results from the first field season are outlined in ***Section 1b. Studies and Investigations*** under "Roanoke River NWR "The Effects of Artificial Canopy Gap Creation on the Growth and Development of Bald Cypress Advanced Regeneration on the Lower Roanoke River Floodplain, NE NC" (08- 42360-01)."

The second project submitted was to restore the hydrology on approximately 1,100 acres on the Refuge's Rainbow Tract. Three man-made canals are proposed to be plugged. Two are located on the River proper (BN1 and BN2) just upstream of Black Gut. The third canal is located in from the River off from Black Gut that extends into the swamp along an old logging road that runs east-west. After a series of meetings with agency stakeholders, in February 2005 and again in 2006, it was decided by Refuge staff that permanent plugs with no water control structures would be inserted in the canals in an effort to restore the hydrology in this part of the floodplain. Ducks Unlimited engineered the project, developed the scope of work, handled the bids, awarded the contract and oversaw construction on the ground. After completion of a USACOE Individual Permit, Division of Coastal Management's Federal Consistency Determination, 401 Certification from NC Division of Water Quality, and responding to concerns raised by the NC Division of Marine Fisheries, the Refuge gave DU the go-ahead to begin work. No major snags were encountered during construction. Materials were trucked in using low impact equipment via the floodplain to the two canals (BN1 and BN2) versus barging equipment and materials to the project sites. WB Richter met with equipment operators

before construction began to map out a 10' wide route through the floodplain to avoid impacts to sensitive habitat. Phelps and White, Inc. was awarded the contract to complete the construction. Work began in September 2008 and was completed in October the same year.

A weeklong 20,000 cfs discharge from Roanoke Rapids Dam in January of this year was the first test to see how the plugs would hold up to high water. WB Richter surveyed the area by foot, vehicle, and canoe and was surprised by the results. Most notable was the significantly lower water levels in the sloughs that Town Swamp Main Road traverses Also in the large interior swamplands that the plugs are directly associated with, water levels were 3-5 feet lower than if the plugs were not in place providing excellent habitat for waterfowl and wading birds. In late June another flood event occurred that lasted 14 days, one week longer than the first. Acting RM Pete Campbell and WB Richter checked the plugs from the River and found that there were major problems. The River had worked its way around the wing-walls of the two plugs setting the footprint for a new canal. A significant design flaw, the wing walls were not high enough or long enough to keep the River out during prolonged high flow events. In addition, water was overtopping the third plug off from Black Gut allowing water to flow over the plug on to the floodplain defeating the whole purpose of the plug. Acting RM Campbell and WB Richter contacted Craig LeSchack of Ducks Unlimited and informed them of the problem. DU was willing to take responsibility for the engineering flaw. WB Richter and Acting RM Kendall Smith met on site with DU Engineer, Billy Webster, to assess the problem and find a solution. During the site visit Mr. Webster admitted his mistake and said he should have placed the plug one foot higher which would have put the plug at the same elevation as the river levee. To correct the problem it was decided the wing-walls need to be raised and extended approximately 15 feet to tie them into the levee. In addition, the height of the plug will be raised two feet. Also, an earthen berm is to be constructed at the site of the third plug to prevent water from overtopping the levee along Black Gut. The scope of work to repair the design flaw was put out for bid by DU. Three bids were received in August and lowest was accepted. DU agreed to cover the cost of extending and raising the wing-walls and the FWS agreed to cover the cost of raising the plug and agreed to build the earthen berm with Refuge resources. The lowest bid came in at $83,000 to correct the problems with the two plugs along the River. DU would cover $54,000 and the Refuge was able to scrounge up $29,000 and transfer it to DU via a Challenge-Cost Share Agreement. The contract was awarded in September, dry conditions were present for approximately six weeks and the work never commenced. Heavy rainfall began in mid-November and persisted for the rest of the year causing discharges from the Roanoke Rapids Dam to be at a steady 20,000 cfs. The big concern is the additional damage to the plugs after the prolonged flood event. That concern was realized after the Basin experienced one of the wettest winters recorded. As a result, the USACE had the river in flood control mode prescribing discharges of 20,000 cfs from mid-November into April. Damage to the plugs was significant. The river cut a new canal approximately eight feet deep ranging from three to five feet in width around the downstream wing wall of Plug #1 (upstream most plug). Damage to Plug #2 wasn't as severe. A small channel approximately three feet deep and three feet wide was cut around the upstream wing-wall. Work to correct the engineering flaws in the wing-walls

and plug heights was completed in September. Refuge staff will be responsible for building an earthen berm to raise Plug #3 located off from Black Gut. If conditions are dry enough that work will be completed in 2011.

2b. Upland restoration: On Refuge

Before FWS purchased the Town Swamp Tract, International Paper cut a large percentage of the hardwoods located in upland areas that are no longer flooded. Left behind were four one-half to one acre areas that were used as loading and staging areas during harvest operations. These areas have remained open with none-to-minimal tree regeneration occurring. In February of 2008, Refuge staff, along with Anthony Davis and Kenny Powell, Pocosin Lakes NWR, and Volunteer Curt Kedley, planted 515 hardwood trees in these areas. Tree species planted were swamp chestnut oak, willow oak, cherry bark oak, black walnut, and persimmon. Plot 1 is located across from Rascoe's Ridge, measures 43 x 45 m, and twenty-five of each of the five species were planted. Plot 2 is located alongside Town Swamp main road, measures 36 x 34 m, and 23 cherry bark oak, and twenty each of persimmon, swamp chestnut oak, black walnut, and willow oak were planted. Plot 3 is located alongside Hickory Ridge Road, measures 48 x 45 m, and 35 cherry bark oak, 26 swamp chestnut oak, and 25 each of persimmon, willow oak, and black walnut were planted. Plot 4 is located off from Break-of-Dam Road, measures 16 x 97 m, and 30 each of the five species were planted. WB Richter checked on the survival status of the trees during the growing season. The persimmon were doing excellent, all the oaks specifically cherry bark had very high survivorship with volunteer oaks coming in on their own. Black walnut on the other hand had very low survivorship. While checking survivorship, WB Richter observed Mimosa (*Albizia julibrissin*) shrubs had become established in the restoration plot located along Town Swamp Main Road closest to Rascoe's Ridge. Upon further investigation it appears the Mimosa has become well established in the young pine plantation bordering the plot.

2c. Wetland Restoration: Off-Refuge

Nothing to report.

2d. Upland Restoration: Off-Refuge

Nothing to report.

3

Habitat Management

3a. Manage Water Levels

Managing water levels means something different at the Roanoke River National Wildlife Refuge. Water is the driving force in a bottomland hardwood forest ecosystem. Over the years water has carved the floodplain and dictated where and what plant and wildlife species are found in the bottomland system. The dams located upstream of Refuge lands manage the water levels downstream in ways that do not mimic what would happen naturally. It is impossible to manage water levels on Refuge lands when water enters from different points along the River. This year the annual hydrograph showing discharges from Roanoke Rapids dam indicated the wettest winter on record. Rainfall events beginning in mid-November of 2010 extending well into March kept the River in flood control mode until April. Rainfall events after that were few and far between with very heavy rain events when it did rain. The summer brought very dry conditions and hot temperatures causing the swamps to dry up. Rain events during the fall and winter kept the swamps wet providing ideal water levels for waterfowl. See hydrograph at the beginning of this Annual Narrative.

3b. Manage Moist Soil Units

Green Tree Reservoir Project-Askew Tract – For background information on this project refer to the 2007 Annual Narrative. The purpose of this project was to impound water in forested areas during the dormant season to provide habitat for migrating and wintering waterfowl. During periods of extreme drought water can be pumped into the northwest side of the project via a well to provide waterfowl access to habitat they would otherwise not have access to. After 3 ½ years with the project in place the Refuge staff is finding that the project is proving to be difficult to manage and is not meeting all of its intended objectives. One of the challenges is that the project is tied directly to the hydrology of the River. Any flows equal, or greater than, 12,000 cfs will cause water to enter the southeast impoundment via low points along Conine Creek; this is of greatest concern when flows of 12,000 cfs or greater occur during the growing season. The only culvert to drain this impoundment is undersized, is not able to drain water in a timely manner, and can only remain open during work hours otherwise beaver will dam it. A result of having only one small culvert is that several acres of hardwoods may remain flooded in the impoundment during the growing season. Other concerns include the seepage of water into the north impoundment (area north side of the logging road) at flows greater than 12,000 cfs causing this area that was intended to stay dry during the growing season, to become partially inundated. On 22 February 2008, Refuge staff toured the project area with PL Mike Bryant and Deputy PL Scott Lanier, Alligator River NWR, to discuss

problems with project design. On 29 April 2008, Refuge staff met on-site with former FWS Migratory Bird Biologist Bob Noffsinger (one of the original planners of the project), current Migratory Bird Biologist John Stanton, and Private Lands Biologist Kendall Smith to discuss the project design and possible solutions to the problems. A couple of solutions were proposed for the problem with the southeast impoundment: 1) to place another culvert under the road; or 2) to place a rock ford in a once historic low point in the road. Refuge staff will continue to search for different solutions and determine which one will best address the problem. RM Connolly decided against the low water crossing, and is instead placing another water control structure in the road. This structure has a Clemson beaver deceiver device built into it that should allow the culvert to stay open 24/7, and will be installed in 2011.

As mentioned above, this project continues to be challenging. As of 2010, Refuge staff has been attempting to more actively manage this project. On 15 September 2010, Mr. Noffsinger was asked to come out to provide general information on managing moist soil units, and show us the methods used in the baseline vegetation surveys conducted in fall 2002 at Askew. In mid-November 2010, Refuge staff, along with a group of scientists present for a "Refuge Pulse-Check," toured the Askew Tract and offered additional comments and advice on the feasibility of this project. The general consensus was that with the money and effort already invested into this project, we should make a valid attempt at managing it before we decide it is unmanageable.

BT Railey has forged on with the implementation of suggestions in the Askew Green Tree Reservoir Management Plan. Vegetation and waterfowl surveys have been conducted (see page 10 of this Annual Narrative), as well as monthly water level probe downloads; a report on the project will be available in 2011. Although the Askew Unit is not a "perfect" example of a working moist soil unit, current efforts to manage the water levels are showing that, with much effort, some control can be exercised over some of the impoundments. It will be interesting to see what impacts the beaver deceiver will have once it is in place. It is hoped that more active water level management, monitoring, and surveys will continue on a regular basis in future years, so that we may get a more clear picture of how the River flows are affecting the emergent vegetation and waterfowl use of it.

3c. Graze/Mow/Hay

Roads on Broadneck were mowed in August. Company Swamp was mowed in September. Roads on Conine and Askew were mowed in September, along with the Kuralt Trail parking area, which was also mowed in June.

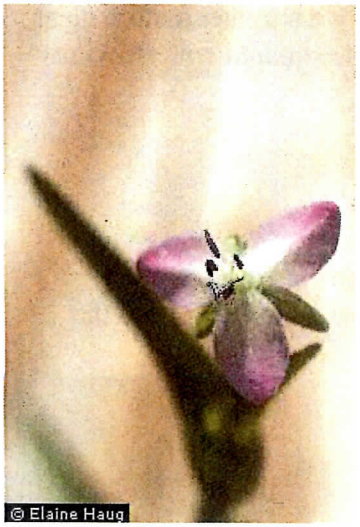
3d. Forest Cutting

Nothing to report.

3d. Control Pest Plants

While checking survivorship, WB Richter observed Mimosa (*Albizia julibrissin*) shrubs had become established in the forest restoration plot located along Town Swamp Main Road closest to Rascoe's Ridge. Upon further investigation it appears the Mimosa has become well established in the young pine plantation bordering the plot, hence the source of the Mimosa in the forest restoration plot. EEO Wilkins, BT Railey, and Summer Intern Leeb began the arduous task of trying to control the Mimosa, employing a hack and squirt method with the herbicide "Habitat." It will take a few years before Refuge staff can get it under control, and may require more aggressive methods. Treating invasive plants was identified as one of the Refuge's Top Three Critical Needs during the Nov.15 - 17, 2010 "Pulse Check." It was recommended that an Americorps strike team be employed to handle the Mimosa, Chinese privet (*Ligustrum sinense*), and any other exotics we may need to aggressively control. WB Richter has also observed pockets of Chinese privet in the mixed hardwood plantation on the Rainbow unit while conducting point counts in this area.

EEO Wilkins, BT Railey, and Intern Leeb spent several hours applying Habitat to the canals at Askew East in an attempt to control the invasive alligator weed (*Alternanthera philoxeroides*) and parrot feather watermilfoil (*Myriophyllum aquaticum*). While doing vegetation surveys at Askew West in September 2010, staff observed an abundance of a previously unidentified plant, the exotic annual emergent *Murdannia keisak,* which goes by a number of common names, including "Marsh Dewflower," "Marsh Dayflower," "Asian Dayflower," and "Asian Spiderwort." Like other dayflower species that were introduced from Asia, it forms dense mats and out-competes native species. BT Railey identified two other species on the Refuge from the Commelina family – the native Virginia Dayflower (*C. virginica*) and exotic Asiatic Dayflower (*C. communis*). See photos below. The *Murdannia sp.* should be researched to determine the best method of control.



Murdannia keisak – Marsh Dewflower (exotic)

Commelina virginica – VA Dayflower (native)

Commelina communis
– Asiatic Dayflower (exotic)

4

Fish and Wildlife Management

4a. Bird Banding

The Refuge had a pre-season banding quota of 125 wood ducks. This year, only 22 wood ducks had been banded missing the pre-season banding quota by 103. Lack of rainfall June thru early September resulted in the water drying up at the banding site.

4b. Disease monitoring and treatment

Nothing to report.

4c. Re-introductions

Nothing to report.

4d. Provide nest structures

Nothing to report.

4e. Predator and exotic control

Fire ants had been becoming more prevalent along the Askew East and West road, portions of the Town Swamp Main Road, and along the Company Swamp right-of-way in past years. However, this year there was not a lot of fire ant activity observed. This could be due to the very wet and cold conditions experienced during the winter last year. Refuge staff will continue to be vigilant about treating these mounds in the future in an effort to control the spread of the ants.

Nutria and beaver continue to cause adverse effects at Askew. Some control was implemented by the Refuge Manager.

5

Coordination Activities

5a(1). Interagency coordination

USACOE 216 study – For background on the USACOE Section 216 Study and for a review of the progress that has been made on the study in previous years refer to the Annual Narratives from 2001-2007.

The following progress has been made this year on the study that is now due to be completed in 2012:

- Dr. Cliff Hupp, USGS, collected data for the Roanoke River (River) bank erosion study that was contracted by USACOE; a final report was submitted to the USACOE. For a summary of findings, see "Roanoke River NWR "The Effect of a Managed Flow Regime on the Bank Morphology of the Roanoke River NWR" (02-42630-03)" under ***Section 1b. Studies and Investigations*** in the 2009 Annual Narrative.
- USACOE has agreed to fund part of the study being carried out by VA Tech Professor, Dr. Diplas. Dr. Diplas is looking at the effects of hydropower peaking on bank stability. This study will also look at what types of flow regimes, in addition to peaking, cause the banks to collapse. The results of the VT study are outlined and discussed below under Dominion Generation Relicensing Studies.
- Dr. Jarad Bales, USGS, formerly Raleigh, NC, was the lead in developing water quality monitoring tools for this study; however, Dr. Bales relocated to Reston, VA, as Chief of Water Resources. Ana Marie Garcia, USGS, Raleigh, and her colleagues have taken over Dr. Bales' duties in developing a water quality model that can be used to assess the effects of changes in John H. Kerr operations on DO levels in the River and floodplain from the base of the Roanoke Rapids Dam downstream to the mouth of the River. The USGS study will utilize a 3-dimensional hydrodynamic model that will be linked to a 3-dimensional in-stream water quality model. Once these modeling tools are created they will be used to simulate eight different water quality management scenarios that have been proposed by the Water Quality workgroup. The results of these efforts, may lead to additional measures regarding changes in operations at the reservoir, as well as providing information that could be used to evaluate the effects of measures on habitat in the downstream floodplain. A draft model has been produced; however, USGS has not yet run the different flow scenarios through the model.
- A new twist of events developed for the downstream riparian team. To everyone's surprise, the USACE began an environmental benefits analysis of the

downstream floodplain ecosystem. What this entails is assessing baseline conditions; i.e., forest health, species composition and distribution of the floodplain forest that is affected by the USACE's flood control operations. To do this the USACE proposed using a hydrogeomorphic model. The HGM model was developed by collecting data on species distribution relative to hydrology, stream type, gradient on which a plant community can be found from river systems throughout the southeast. Similar data collected from the Roanoke River floodplain would be plugged into the model and compared on a regional basis. There was one big concern about this approach in that it was very qualitative, and it wasn't able to quantify ecosystem functions. One other concern was that many of the reference points used to construct the model came from the Roanoke River. These types of concerns prompted the downstream riparian team to discard the hydrogeomorphic approach. Instead the group worked with the USACE's research branch out of Mississippi to derive a model that would somehow characterize the floodplain forest. The group hesitantly went ahead with a paired watershed approach (Tar River) and compare data from the Roanoke River to other southeastern river. Data was collected on forest species composition relative to hydrologic location on the floodplain and data on tree health, location of species in the vertical structure etc. The data collected from the Roanoke River floodplain was assessed by comparing the current condition of the floodplain ecology to reference data. The reference data would be that of the Tar River floodplain. Although there were serious concerns about using the Tar River, a nearby unregulated river, as a reference for the Roanoke mainly due to scale (the Tar River floodplain is much smaller than the Roanoke) it was all we had. Data collected from the Roanoke River was also compared with US Forest Service's Forest Inventory and Analysis Database and compared. It was critical that the USACE had a good baseline so they can assess the impact of the current operations of their flood control project as well as assess the effects of proposed release alternatives on downstream forest health and wetland functions. In the USACE's cost/benefit analysis, in order to justify changes to how they currently operate their flood control project they need to be able to quantify with and without change an effect on the downstream system. For example, they would be looking at the following: Over the next 50 years, if nothing is done, the project area will provide 10,000 average annual habitat units. Or, over the next 50 years, with Alternative X in place, the project area will provide 15,000 habitat units. Therefore the benefit of Alternative X over the 50 year period is 5,000 habitat units. Does this justify a change? This would be weighed against impacts to hydropower production and recreation etc.

In 2008, TNC, along with the Roanoke River Basin Association, proposed to the USACE Wilmington District an interim adjustment to the guide curve at their John H. Kerr project. The proposal in coordination between TNC, DG, and the Southeastern Power Administration the USACOE is proposing to change the guide curve in a way that would trigger releases in the spring up to 35,000 cfs in order to remove water from the system sooner. The purpose is to modify the water release schedule from Kerr/Gaston/Roanoke Rapids reservoir system to

minimize impacts to downstream bottomland hardwood forests. Two sets of public hearings were held in May and August of 2008 at two different locations (Williamston and Halifax) to inform the landowners on the lower River who would be impacted by such change. The concern is that anything at 20,000 cfs or greater would impact agriculture fields causing significant crop loss if a growing season flood event occurs. Some of the farmers were against changing anything while others see the need for change. Flood maps of areas flooded at 20,000 cfs and 35,000 cfs were generated and laid over aerial photos. During the public hearings landowners were asked to look at their parcel of land to verify whether the information on the maps was correct. The option receiving most attention is 6B. This alternative is the best for minimizing impacts to most resources due to winter releases but there remains agriculture issues. The option would result in less frequent flooding around 20,000 cfs, but more frequent flooding around 35,000 cfs which would result in more agricultural land being flooded; however, the more frequent flood events would occur when fields haven't yet been planted during the months of March and April. Due to modeling uncertainty, a winter release test occurred for five days in January 2009 to determine the threshold of agricultural flooding. It was estimated that with discharges of 20,000 cfs for five days or more, 100 acres of agricultural land is flooded, 500 acres is flooded with discharges of 25,000 cfs for five days or more, and 1,600 acres of agricultural land is flooded when discharges of 30,000 cfs occur for five days or more. Table 4 below lays out the number of days in a month a given discharge would occur under existing operations and under the proposed option 6B. In December the USACE decided that they would not consider Option 6B as an interim adjustment to the guide curve. Instead, they decided to wrap it into the section 216 Study and consider it as one or part of an alternative to be evaluated.

Table 4. Comparison of the number of days the mean daily discharge from Roanoke Rapids at a given range of flows would occur with existing operations versus option 6B. Red numbers correspond to the months that would be effected by the proposed changes in the guide curve.

Existing	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
20,000 to 24,999cfs	62	80	93	75	47	24	18	11	20	31	29	37
25,000 to 29,999	1	6	9	10	3	3	1	1	2	1	0	0
30,000 to 34,999	0	0	0	0	0	0	0	0	0	0	0	0
35,000cfs and above	1	2	1	8	6	0	0	1	3	1	0	0
Total # Days	**64**	**88**	**103**	**93**	**56**	**27**	**19**	**13**	**25**	**33**	**29**	**37**
Option 6B												
20,000 to 24,999cfs	56	62	39	17	8	5	14	14	20	32	28	41
25,000 to 29,999	0	0	1	13	6	1	0	1	2	1	0	0
30,000 to 34,999	0	0	4	9	2	2	1	0	0	0	0	0
35,000cfs and above	12	13	14	20	11	3	0	1	3	1	0	0
Total # Days	**68**	**75**	**58**	**59**	**27**	**11**	**15**	**16**	**25**	**34**	**28**	**41**

The USACOE, Wilmington Office, continues to hold informative conference calls every Tuesday to involve stakeholders in any water management related issues in those River Basins where the USACOE has flood control or water supply projects. When time permits, and flow issues are apparent, WB Richter will call in to voice concerns regarding Refuge resources.

Dominion Generation Relicensing Studies - See previous Annual Narratives for a history of relicensing efforts and progress. A 40-year license was issued to DG in early 2005. DG continued to follow its responsibilities under their new license agreement; e.g., there is now 325 cfs of water flowing through the bypass reach. WB Richter is a member of the Cooperative Management Teams (CMTs) that will discuss the FL4 (Article 415) - downstream ecological impacts of within-week peaking, FL3 (Article 414) - downstream ecological impacts of within-day peaking, and FL7-downstream water quality.

The FL4-downstream ecological impacts of within-week peaking team, FL3-downstream ecological impacts of within-day peaking CMTs met on 12 January this year to discuss progress being made on the studies being carried out under the respective articles.

The following progress has been made in the following study areas:

- Effects of Hydropower Peaking on Bank Stability: Dr. Panos Diplas, VA Tech University (VT), was awarded a contract to determine the impacts DG's hydropower peaking has on bank stability. This study has been further enhanced through financial support by the USACOE to look at the impacts flood control operations have on bank stability. Data on soil characteristics such as pore water pressure distribution in the soil, slope stability, bank shear stress distribution, erosion, soil adhesion coefficients, etc., have been analyzed and input into a model. Some of the variables in the model being looked at are: magnitude of the base flow, magnitude of the maximum flow, time to ramp up to peaking, time to ramp down from peaking, duration of max flow, and duration of base flow between peaking events. The next step is to determine which flow scenarios should be investigated. Each flow scenario will be analyzed with a step-by-step approach leading to a fully coupled model to determine the impacts of a flow release on erosion and riverbank stability. The coupled model will include individual models for flow, seepage, erosion, and slope stability. In addition to the work already proposed, the CMT agreed to fund additional work that would assist the researchers at VT better answer some questions and to be able to produce a more robust study. Specifically, the additional work will address three items. One, previously discussed with the John H. Kerr 216 Study Work Group 3, would be to provide an opinion on the effects of 35,000 cfs releases on bank retreat relative to the effects of 20,000 cfs releases. The second would be to assess the effects of stepped-down discharges from maximum flood releases per the Roanoke River Betterment Plan, and provide recommendations for feasible alternatives less likely to contribute to bank retreat. The analysis should include a step-down scheme that would minimize bank retreat. The last would be to

characterize soils permeability along the VT study reach, based on VT samples and possibly USGS samples.

The Executive Summary of the final report dated 22 December can be found below. This report serves to summarize the work that has been completed on erosion and stability since the last report, submitted December 2009. The work carried out for this report includes additional field work to characterize the permeability and erodibility of the bank soils, improved numerical simulations of river flow and bank stability, as well as analyses of step-down scenarios and overbank flows. About one week was spent in the field performing additional jet tests for erodibility and several different in situ permeability tests in an effort to improve the estimates of various important soil parameters/properties. Further permeability tests were completed in the laboratory. Access to a new preprocessing program, ICEM-CFD, allowed improved numerical meshes to be generated for the computational fluid dynamics (CFD) analysis. The results of these simulations provide a more accurate and detailed picture of the flow processes on the lower Roanoke River and how they affect fluvial erosion. Slope stability modeling was extended to include all five study sites under steady state and transient flow conditions. The slope stability analysis also benefited from the detailed investigation into the permeability of the riverbank soil.

These refinements in modeling were used to assess the impacts of different flow releases on fluvial erosion and bank stability. Among the scenarios, two new cases were also considered in detail; that of the step-down in flow rate following flood control releases and an increase in the flood control flow rate. The current flood control flow rate of 20,000 cfs results in bankfull conditions along the study reach. Thus, an increase in this flow rate will result in overbank flow, where the river water spills onto the floodplain introducing additional complexities to the dynamic behavior of the flow. A simplified approach is used to estimate the effects of increasing the flood control flow releases from 20,000 cfs to 35,000 cfs on riverbank stability.

While details of each analysis are provided in the report, a summary of the important conclusions is provided below. Further discussion of each topic can be found in the final chapter of this report.

- The types of cohesive soils in the riverbank have similar engineering properties but exhibit a wide range of erodibility parameters. This finding is not uncommon and is supported by the significant variability in the erosion pin data at various sites.
- The cohesive riverbank soils are resistant to fluvial erosion and significant erosion is not expected for flows below 20,000 cfs.
- Soil permeability values measured in situ and in the laboratory differed by several orders of magnitude. The results from the in situ tests best matched the observations from the groundwater table monitoring.

- The riverbanks at the study sites are stable in their present condition with regards to large scale failures. This result does not preclude the occurrence of occasional failure events over the lengthy river reach.
- Small scale failures produce lower factors of safety especially in the presence of tension cracks.
- The step-down scenario described in the lower Roanoke River Betterment Plan does not have an adverse effect on riverbank stability.
- A flow rate of 35,000 cfs will result in overbank flow throughout much of the lower Roanoke River. This flow condition will not result in an increase in instability of the riverbanks compared to steady flow bankfull conditions. The present simplified numerical approach is not able to determine the effects of the designated overbank flow on fluvial erosion. This is a very challenging problem requiring more advanced and elaborate numerical simulations of fluid flow along with more detailed information about floodplain topography and roughness.

The report submitted to the CMT was the final report for the erosion study. WB Richter submitted comments to the CMT on the report. The study sites that VT used were concentrated in the lower part of the upper reach of the river (between HWY 258 and just upstream of Big Swash). For the effects of peaking on bank stability these study sites are fine; however, caution must be taken to the conclusions made with regards to the effects of flood control on bank stability. The conclusions made in the study with regards to flood control operations on bank stability cannot be extrapolated beyond the reach of the study sites. If the VT study team had been working in the reach of the river between HWY 11/42 and Williamston it is believed the conclusions in the executive summary with regards to flood control would be much different. In other words, the study did not collect data in the reach of the river that is currently experiencing the highest rates of erosion; therefore, the USACE should not be using the results to interpret the effects of flood control on bank stability on the lower Roanoke River.

- Hardwood Regeneration: Dr. Robert Peet, UNC - Chapel Hill, is the Principle Investigator for this study. Under the guidance of Dr. Peet, Doctoral student Ms. Jackie White was recruited to carry out the hardwood regeneration study DG is required to do as part of their settlement agreement. Ms. White completed her third field season this year. Refer to past Annual Narratives for background information on design. The goal of this study is to assess the impact of Roanoke Rapids Dam operations, specifically peaking operations, on the establishment and survivorship of tree seedlings on the downstream bottomland hardwood forest system. Data was recorded on 118 seedling plots. The plots, located between Weldon and Devil's Gut span an array of hydrological gradients on the floodplain that are impacted by DG's flow releases as well as the USACOE's releases. Thirty-nine plots are located in the zone of inundation when flow releases are between 5,000 - 14,000 cfs for five or more days; this is the zone that DG is thought to have an impact on during their peaking operations. Fifty-four plots are located in the 15,000 - 20,000 cfs zone of inundation and 35 plots are located

within the zone of greater than 20,000 cfs. Intensive seedling counts and measurements were taken on two smaller 5 m x 1 m plots nested within the bigger plot. In-situ Level Trolls have also been placed in select locations near the seedling plots in order to monitor the extent and duration of flooding of the seedling plots. DG's study differs from the seedling plots monitored by WB Richter whose plots are located in the hardwood zone impacted by flows greater than 18,500 cfs. Ms. White's study is partially funded by FWS using Challenge-Cost Share Agreement grant funds matched by DG; $15,000 of FWS funds have been contributed this year to the study for the past three years. Next year will be Ms. White's last field seasons to assess the impacts of DG's operations on downstream bottomland hardwood forest regeneration.

Some of the results of the study to date are described below:

- Total seedling abundance during the initial sample increased from 2007 - 2010.
- In 2010, 66,246 tree seedlings were tallied, the most observed in any sample but only 20,047 seedlings survived the 2010 growing season.
- The highest within-year mortality (78%) occurred in 2009 following prolonged growing season flooding.
- First year seedlings represent the bulk of those tallied in all years.
- The number of germinants increased from 2007 to 2010 peaking at 58,557 in initial 2010 sample. The majority of these (21,234) were swamp cottonwood, a prolific seeder that requires bare moist substrate for germination.
- The abundance of older (>1 year) seedlings increased from 2007-2009, but between spring 2009 and spring 2010 abundance declined by 37% from 12,267 to 7,689 individuals
- High mortality was observed between the 2009 recount and the 2010 initial sample most likely due to a 132 day inundation period during the dormant season. However, most seedlings survived through the 2010 growing season.

Table 5. Total number of older seedlings by sampling event

Year	Initial	Recount	Survival
2007	**9349**	**8367**	**89%**
2008	**11601***	**12672**	**109%**
2009	**12267**	**9736**	**79%**
2010	**7689**	**7534**	***98%***

*reflects a 20% increase in sample size.

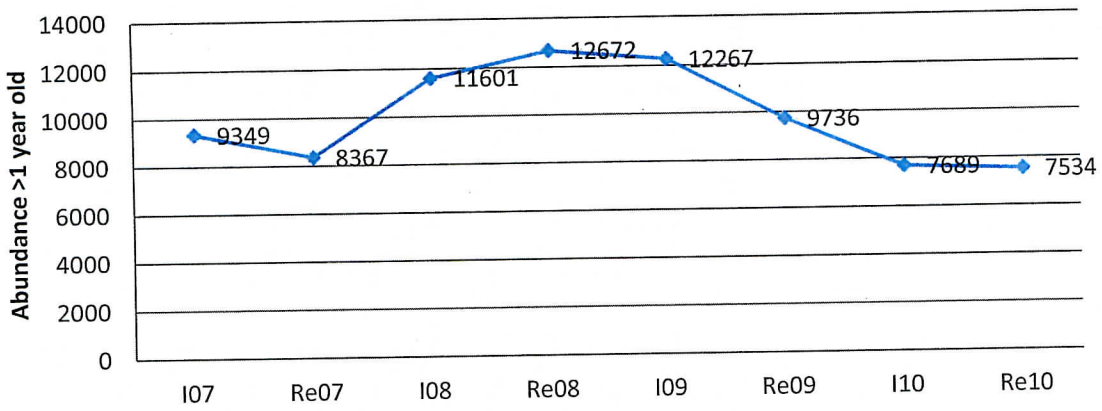


Figure 3: Trends in >1yr old seedlings (2007 - 2010). Note I07 is initial seedling count in 2007 and Re07 is the recount in 2007.

In 2011, the final year of the study, work will concentrate on:

- Looking at trends with individual species and determine the relationship between inundation duration and seedling establishment and survival.
- Continue to explore the accuracy of the flood inundation model using the well data collected in 2007-2010.
- Relate tree seedling demographics as well as changes of the species through the forest strata to deviations in hydroperiod across the lower Roanoke River floodplain.
- Sample all plots during the 2011 growing season using the recount protocol in order to better characterize the response of the seedlings to intra-annual variation.
- Monument plots in wetter areas with rebar and pvc.

A final report of Ms. White's work is expected in October 2011.

- Effects of Hydropower Peaking on Benthic Macroinvertebrates: Dr. Leonard Smock, Virginia Commonwealth University, was awarded the contract to study the effects of hydropower peaking on macroinvertebrates both in-stream and in-tributaries. Background information concerning this study can be obtained from the 2007 thru 2009 Annual Narratives. This year was the fourth year of the study. There are three questions being examined for the macroinvertebrate study are stated below and findings to date summarized after each.

  Q1) Does hydropower peaking affect the general health of the benthic community in the Roanoke River upstream of Weldon?

  Macroinvertebrate drift sampling provided conclusive evidence of peaking effects for both 2008 and 2009. Most notably, hydropeaking was associated with a large (several orders of magnitude) increase in the abundance of drifting macroinvertebrates in the system.

Q2) Is there a longitudinal effect of hydropower peaking on the benthic community downstream from the source of peaking?

No clear evidence of hydropeaking was obtained from the longitudinal sampling. Inherent natural variations in hydrology and geomorphology among the longitudinal study sites were identified as confounding factors for using benthic community comparisons among them to assess peaking effects. Therefore, the longitudinal investigation was discontinued after 2008. In 2009 time and resources were reallocated to the artificial substrate investigation discussed above.

The spatial and temporal effects of hydropeaking were examined in more detail during this year. There were 6 drift sampling events on the Roanoke River at Roanoke Rapids this year, with one of the events including simultaneous sampling at Weldon. In addition, drift samples were taken on the James River, a river with no hydropower peaking. Results of this year's work have not yet been completely analyzed. A final report is due in the fall of 2011.

Q3) Does hydropower peaking affect the general health of the benthic community in tributaries to the Roanoke River that are inundated during peaking?

For each of the three study years, macroinvertebrates were sampled in wadeable tributary streams to the Roanoke River according to the NCDENR protocol for wadeable swamp streams (NCDENR 2006). Two second- to third-order tributary streams to the Roanoke River, Quankey Creek and Looking Glass Run, were chosen based on hydrologic data from periods of normal flow and during peaking events that indicated that the lower reaches of these streams were affected by hydropeaking. Samples collected from the Roanoke River tributary sites were compared to those collected from Tyson Creek, a tributary of the Tar River, which is not affected by hydropeaking. In addition to the macroinvertebrate sampling conducted, in order to more completely assess whether hydropeaking affected the hydrology of the streams, water level monitors were installed at the tributary sites in 2008 and 2009. The water level monitoring data showed no evidence that any of the study sites were affected by hydropeaking in 2008 or 2009. In 2009, the lower (downstream) sampling site along Looking Glass Run exhibited a water level rise that was associated with the sustained high flow on the Roanoke River mainstem that occurred during flood control operations. Macroinvertebrate sampling indicated that the downstream Looking Glass Run site generally exhibited the lowest overall ecological integrity of the study site. The results of the tributary investigation provides preliminary evidence that the macroinvertebrate communities of Looking Glass Run may be affected by hydrologic modification on the River's mainstem; however, because there was no hard evidence of this, it was concluded that work in the tributaries will not continue this year. This will allow more time and effort to be put towards looking at Questions 1 and 2.

- Effects of Hydropower Peaking on Fish Communities below the dam at Roanoke Rapids: Dr. Stephen McIninch, Virginia Commonwealth University, was awarded the contract to look at the effects of hydropower peaking on the fish communities below the dam at Roanoke Rapids. Background information concerning this study can be obtained from the 2007, 2008, and 2009 Annual Narratives. The two questions being examined for this fish study are stated below and findings from the work carried out from 2007 - 2009 are summarized after each question below:

  Q1) Does hydropower peaking effect fish community composition in the channel and shallow water habitats of the Roanoke River upstream of Weldon, NC?

  The small amount of fish community variation observed during the three-year study period supports the possibility that the present assemblage has adapted to a regulated flow regime. Additional information on adaptations in life history and behavioral traits would aid in the understanding of how riverine fish communities adapt to regulated conditions in the southeastern coastal plain.

  Q2) Is there a longitudinal pattern of fish community variation away from the source of peaking?

  The fish community of the Roanoke River between Roanoke Rapids and Hamilton does not exhibit variation that may at this time be attributed solely to hydropeaking. Variation in hydrology, river morphometry, and habitat structure along longitudinal gradient may account for variation in community structure and species abundance in riverine ecosystems. Likewise, differences between corresponding sites from the Cape Fear and Neuse Rivers cannot be attributed to hydropeaking at this time.

The results of the three years of fish studies were inconclusive as to whether hydropower peaking has an effect on the fish communities below the dams with regards to species composition and longitudinal distribution. The matter was passed on to the diadromous fish team. The fisheries CMT decided not to proceed with another year of fish studies that would most likely produce inconclusive results.

Other relicensing studies that are also underway that Refuge staff are not necessarily involved include American eel passage at Roanoke Rapids and Gaston dams and investigations on American shad to determine if passage is required.

Dominion Generation Transmission Line Right-of-Ways (ROW) – Mr. Joshua (Josh) Wirley, Joshua.a.whirley@dom.com, 434-414-6971, is the contact within DG to coordinate ROW maintenance activities. WB Richter coordinated with Mike Brucato on the management of the Company Swamp DG ROW. Mr. Brucato and WB Richter walked the ROW on 28 October and identified a few danger trees. High water prevented the crew from getting on site to cut the trees last year; however, the contractors were able to access the area in September and were able to cut back the targeted trees. WB Richter believes that the cutting that was done was much more than what DG and Refuge staff

had discussed the prior year. Closer supervision will be necessary when DG proposes to cut back trees.

5a(2). Intra-agency coordination

WB Richter continued to work with USGS staff, Reston, VA, on the Large Woody Debris Study. An Intra-agency Agreement set up last year between the Refuge and USGS, Fish and Wildlife Coop Unit, Clemson University, for work on restoring cypress trees to the swamp forests on the Rainbow Tract continues for one more year. Refuge staff continue to support the hydro-acrostic work on migratory fish being carried out by students of Dr. Joe Hightower, NCSU, USGS Fish and Wildlife Coop Unit. A small equipment shed is located on Askew west to protect the computers and acrostic devices from the elements. A transfer of Refuge funds to USGS, Reston, VA was finalized. These funds will be used for travel and per diem costs for USGS staff and volunteers which will allow them to collect data from the clay pads located along established transects throughout the floodplain to estimate rates of sediment deposition.

5b(1). Private land activities (Easements)

The Refuge administers 66 conservation easements by RO Tract (100 easements by Refuge Tract), several of which have been subdivided, totaling approximately 116 sub-tracts. There are 88 unique landowners involved in these easements. Several landowners within a county own more than 1 tract, NCWRC owns 8 tracts in 2 counties, and USFWS has fee title to 2 tracts in 2 counties. These parcels are located in 19 counties in the Roanoke-Tar-Neuse-Cape Fear Ecosystem. The easements total approximately 3,045 acres. The average easement size is approximately 30 acres with the largest easement totaling 346.2 acres and the smallest tract totaling 1.21 acres. The table below shows a breakdown of the holdings by county.

To date there has been no law enforcement action by ZO Canada or SA Baker on the Orange County 13C easement encroachment/motocross activity damage from a neighboring landowner. This is the easement that was subdivided, sold with lots, and currently has nine different landowners. ZO Canada, SA Baker, PLB Smith, and RM Chappell visited easement 13C in Orange County on 11 September 2007 to assess the damage from the motocross activity and look at rehabilitation. BT Railey and WB Richter inspected this easement on 13 January 2010 and confirmed that rehabilitation was still needed.

BT Railey inspected 53 easements from 01 October 2009 - 19 August 2010 (compliance reports are due each year at the end of August). Of these, 49 were in compliance. RM Connolly suggested that due to the demands of this duty, we should limit inspection to approximately 1/3 of them each year on a 3 year rotation. Details on each easement can be found in the individual easement files kept in a file cabinet in the BT's office.

County	Regional Office Tract Numbers	Refuge Tract Numbers	Number of Landowners	Acres
Alamance County	2	2	6	11.4
Bertie	1	2	1	50.32
Bladen	1	1	1 (NCWRC)	37.96
Caswell	3	3	3	101.23
Cumberland	3	3	3	140.98
Edgecombe	2	2	2	60.67
Franklin	3	3	3	119.8
Gates	1	1	1	82.2
Halifax	3	6	3	83.80
Harnett	1	2	2	42.14
Hertford	1	1	1	125.79
Martin	1	1	1	26.93
Nash	7	18	9 (Includes USFWS)	305.69
Northampton	9	11	10	241.86
Orange	5	5	15	47.67
Rockingham	1	1	1	74.73
Sampson	19	35	25 (Includes USFWS, NCWRC)	1454.03
Wake	2	2	2	25.44
Wilson	1	1	1	11.93
TOTAL	66	100	88	3044.57

All easements are classified as palustrine forested wetlands (Cowardin et. al. 1979 Classification of Wetlands and Deepwater Habitats). Using the general wetland habitat types defined by the "Department of Environment, Health and Natural Resources 1996, A Field Guide to North Carolina Wetlands," the holdings include bottomland hardwoods, pocosin, swamp forest, headwater forest, and beaver swamp complex. These latter classifications should be viewed as tentative.

5b(2). Private land activities (Partners)

Nothing to report.

5c. Cooperative/Friends organizations

Partnership for the Sounds (PFtS) - Nothing to report.

Roanoke River Partners - Nothing to report.

Roanax Sponsas Society, Inc. (RSS) - There has been no activity of the friends group since 2006.

Albemarle-Pamlico Conservation and Communities Collaborative (AP3C) – This collaborative was formed in 2007 by TNC, DU, and the Environmental Defense Fund. The mission of the AP3C is three fold: 1) Develop approaches that integrate economic and ecological resilience for the lands, waters, and communities of the Albemarle-Pamlico Region; 2) Recognize the challenges presented by economic and social distress, climate change, population change, and increasing risks to public health; and 3) Implement collaborative, sustainable solutions for well-being. The AP3C provides an open forum to identify and pursue opportunities for collaborative action among participants and to enhance the coordination of their individual projects. In other words, this collaborative provides a great opportunity to network with people working within the region who have a concern for protecting the natural resources of the region but also recognize the need for economic growth and social well-being. It allows for smart, sustainable growth in the region. Due to time constraints, Refuge Staff did not attend the one meeting held this year; however, FWS employees from other offices did attend. There was only one meeting held this year and no word as to when the next is scheduled. Let's hope this collaborative effort does not waste away.

6

Resource Protection

6a. Law enforcement

There is no permanent law enforcement presence at the Refuge. ZO Canada continues to provide limited law enforcement during Refuge hunts. Violations reported this year include two citations for unlawful camping and several cases of littering and vandalism to boundary signs that did not receive citations.

6b. Wildfire preparedness

A final Fire Management Plan was completed this year and is located in the Refuge files.

6c. Manage permits and economic uses

Nothing to report.

6d. Contaminant investigation and cleanup

There is still no settlement agreement for the old Weyerhaeuser, now Domtar, pulp mill in Plymouth. The EPA, FWS, National Marine Fisheries Service, and NCWRC have been negotiating a settlement from the data collected in a Natural Resources Damage Assessment but with new personnel in place negotiations hit a snag. FWS Contaminants Biologist Tom Augspurger, Raleigh FO, has told us that due to the snag, negotiations have been set back to square one. A final settlement may be take years.

6e. Manage water rights

Nothing to report.

6f. Land acquisition

Nothing to report.

6g. Threats and conflicts

Nothing to report.

7

Education and Recreation

7a. Provide visitor services

Hunting – All hunt opportunities for the Refuge are administered by NCWRC as part of the state's special hunt opportunities; permits are drawn and issued by NCWRC. Many hunting opportunities were available on the Refuge for 2010.

Four 3-day turkey hunts were offered, as well as the annual youth turkey hunt. Turkey hunts began 14 April and ended 7 May.

Conine Island offered hunters early and late season waterfowl hunts in accordance with North Carolina State seasons. Small game hunts were offered seven times between October and December. The entire month of December is open to small game hunting (Monday - Saturday).

Deer hunting was available on five Refuge tracts - Broadneck, Company Swamp, Conine-Askew, Great and Goodman Islands-Hampton Swamp, and Town Swamp. The archery season was open 11 September – 8 October. Muzzleloader season was open from 9 – 15 October. Five three-day regular gun hunts were offered beginning 21 October ending 20 November. There is no accurate way to collect data on hunter show rates at the Refuge.

After receiving complaints from hunters that access to areas of Askew Tract was inadequate due to the drainage canals, BT Railey and EEO Wilkins built and installed three new footbridges.

7b. Outreach

Information Booths, Talks etc. -

WB Richter

- Talk on NWR system and RRNWR to students at Bertie County, STEM school, 31 Mar
- Bird watching on the Roanoke with participants from River Park North Bird Club in Greenville 15 May

OA Jager

- Presented Program on Endangered Species to the 5th Grade Academically and Intellectually Gifted Program at Ahoskie Elementary on 10 Mar
- Presented Nature Program for Tri-County Cub Scouts Twilight Camp each evening 22-25 June
- Manned booth at the Roanoke-Chowan Wildlife Club's National Hunting and Fishing Day in Winton on 25 September

Interpretive Materials –

- Received Cargo for Wildlife/Endangered Species Educators Kit
- Purchased wrist bands, frog & goose pens, pencils, stickers, tattoos, and coloring books.

8

Planning and Administration

8a. Comprehensive management planning

Nothing to report.

8b. General administration

Using Challenge Cost Share funds the Refuge transferred $15,000 to DG for the hardwood regeneration study being carried out by Jackie White. See "Dominion Generation Relicensing Studies, Hardwood Regeneration Study" under ***Section 5a(1). Interagency Coordination*** for details.

OA Jager continues to provide administrative support to Mackay Island NWR, Pocosin Lakes NWR, & Alligator River NWR via telephone and computer contact.

EEO Wilkins continues in his capacity as MOCC instructor at Savannah and Santee NWR's.

The following is a list of employees who were members of the 2010 Roanoke River National Wildlife Refuge staff:

Permanent Full Time	Grade	EOD
Matthew Connolly Refuge Manager	GS-13	11-08-09
Jean M. Richter Wildlife Biologist	GS-12	05/12/96
Diana Tilghman Information Technology Specialist	GS-11	11/08/09
Doak Wilkins Engineering Equipment Operator	WG-10	01/04/98
Rosetta R. Railey Wildlife Biological Science Technician	GS-07	05/10/09

Sherrie E. Jager GS-06 08/20/95
Office Assistant

Volunteers and Interns - In 2010, BT Railey and HEO Wilkins supervised local part-time volunteer Tommy Farrar and summer intern Matt Leeb. Volunteer Farrar assisted with conservation easement monitoring, herpetofaunal surveys, and Refuge maintenance from February-June. Intern Leeb was brought on from June-August and assisted on a variety of both biological and maintenance projects including: invasive species control, herpetofaunal surveys, vegetation surveys, wood duck nest box checks and banding, conservation easement monitoring, posting boundaries, and clearing out water control structures as well as other assorted maintenance duties. BT Railey wrote a successful proposal for funding from the 2010 Youth in Natural Resources Initiative, which brought the refuge $3975 toward the internship expenses, one of 11 Refuge proposals that were accepted in our region. The program worked in coordination with the Student Conservation Association.

BT Railey, Volunteer Farrar and Intern Leeb, also assisted with pelican banding at Pea Island NWR in early July 2010.

2010 was the first time since 2005 that RRNWR housed and employed a summer intern. New staff, new housing, and the disruption of the Gulf Oil Spill all contributed to a slightly bumpy start in this revitalization of our volunteer/intern program. With the proper motivation, training, and well-organized projects to work on, this program has great potential. Once it is more well-established, the benefits of this program will include: lightening the increasing work load of our small staff, involving the local community and thereby instilling a sense of stewardship, and guiding young people toward a career in the environmental sciences.

Training

Matt Connolly

- Project Leader Academy, NCTC, W. Va., 22 Feb - 05 Mar
- Discrimination and Whistleblowing in the Workplace - No Fear, Online, DOILearn, 27 Mar
- Federal Information Systems Security Awareness + Privacy and Records Management, Online, DOILearn, 9 Jul
- Hiring Reform for Supervisors, Managers. and HR Professionals, Online, DOILearn, 20 Oct

Sherrie Jager

- Federal Information Systems Security Awareness + Privacy & Records Management, Online, DOILearn, 22 Feb
- Mastering Microsoft Access, Fred Pryor Seminars, Raleigh, NC, 05-06 May
- 2 IDEAS-PD Refresher, SERO, Atlanta, GA, 17 - 20 May

Rosetta Railey

- 8 hr HAZWOPER Refresher, Online, 12 Mar
- Federal Information Systems Security Awareness + Privacy and Records Management, Online, DOILearn, 12 Apr
- Mastering Microsoft Access, Fred Pryor Seminars, Raleigh, NC, 05 - 06 May
- Post Emergency Spilled Oil Cleanup, Online, TEEX, BP, 23 May
- Intro to Incident Command Sys, ICS-100 for Fed Workers, Online, FEMA, 30 May
- IS-00200.a ICS for Single Resources and Initial Action Incidents ICS-200, Online, FEMA, 9 Jun
- IS-00700.a National Incident Management System, An Introduction, Online, FEMA, 9 Jun

Jean Richter

- Habitat Management Planning, WLD 2125, 9 - 11 Mar
- Federal Information Systems Security Awareness and privacy and Records Management, Online, DOILearn, 22 Mar
- Forestry Workshop, Noxubee NWR, MS, 8 Apr
- Forest Cruise, Clark's River NWR, 26 - 30 Apr
- Pesticide Use All Category Training 4.0 credits, 23 June
- Hazmat Training, Back Bay NWR, 28 - 30 Jun
- Mastering Microsoft Access, Fred Pryor Seminars, 5 - 6 May
- Designing and Implementing a Biological Monitoring Program, WLD 2151, 30 Aug - 3 Sept.
- Aviation Training A-101, 105, 106, 108, 113; online, 6 Dec.

Diana Tilghman

- Federal Information Systems Security Awareness + Privacy and Records Management, Online, DOILearn, 14 Jun
- Getting Started with Wireless Networking, Online, DOILearn, 15 Jul
- Security & the Wireless Environment, Online, DOILearn, 16 Jul
- Windows Server 2003: Security Basics, Online, DOILearn, 26 Jul
- Managing & Troubleshooting Devices, Drivers, Local Security, & User Logon, Online, DOILearn, 27 Jul

Doak Wilkins

- Federal Info Systems Security Awareness & Privacy Records Mgmt, DOI Learn, Online, 17 Mar

FEEDBACK

This year marks the end of the Annual Narrative as we know it. For years, Refuge's Annual Narratives have been a document not just to let the Regional and Headquarters Offices know what has been happening "on the ground" but also as a history to the Refuge. Future Managers and staff can look back upon these and see what was done, in what year, and for what reason. The Service is fluid – people come and go; habitat and terrain change. Memory and word of mouth is lost or incorrect. These Narratives ensure that a comprehensive accurate history exists for future generations.

Staff at Roanoke River National Wildlife Refuge look upon the Service's decision to abandon these Narratives as a decision made in haste and without foresight. A decision we feel will, in time, come to be regretted.

Our Refuge has made the decision to continue these Annual Narratives for our files in order to continue to document the history of these public lands we have been entrusted to manage, care for, and protect; not only for now but for generations yet to come.